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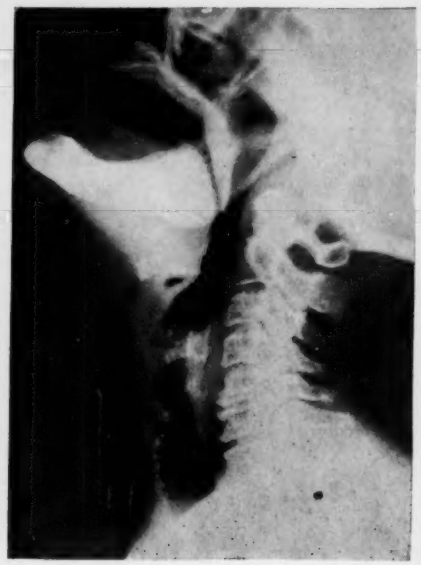

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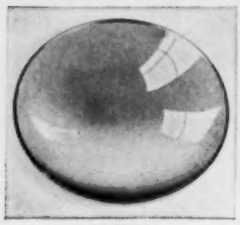

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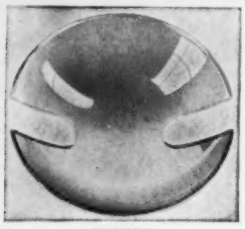

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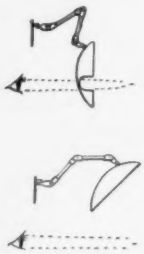

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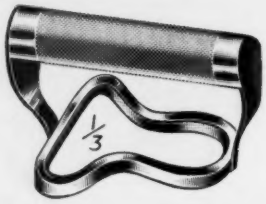

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Esophagitis and Stricture from Regurgitation

L. REED CRANMER, M.D., Toledo, Ohio

Esophageal pathology has rarely received the attention it deserves. Its symptoms have frequently been attributed to cardiac, pulmonary, gastric, and gall-bladder disease. Perhaps this is because lesions in the esophagus may be secondary, as we shall see, to diseases of the above organs. It should be of fairly general interest to call attention to a little-known entity, which is probably much commoner than is realized. This entity is the irritative inflammatory change of the esophagus produced by the reflux of acid-peptic gastric contents into the esophagus from a variety of causes. This is not a new observation and an excellent summary of the literature has been published by several authors.*

The unfortunate chain of events involved deserves our serious consideration because relatively innocuous symptoms may insidiously lead to considerable morbidity, disability, and even mortality. These eventualities may be averted by timely and simple intervention in the early stages. However, even with total obstruction skillful management may result in cure.

The pathology is typically present in the lower third of the esophagus. An incompetent cardiac sphincter and the frequent association with hiatus hernia have been mentioned.[1] Early there is hyperemia with hemorrhagic areas. There may be a reflex spasm of the lower esophagus. As the disease progresses ulcerations develop, which are typically superficial and flat, show little annular infiltration,[9] and absence of exuberant granulations (C. L. Jackson). Two types of ulceration have been differentiated by Beaconsfield[1]: first, the soft, superficial, and often intermittent ulceration associated with reflex esophagitis, and, second, the chronic peptic ulcerations present in a thoracic stomach. Later cicatricial stenosis, either partial or complete, occurs, as the body attempts to heal the ulcerations. However, the resulting obstruction may cause stagnation of secretions and food, with a bacterial inflammatory esophagitis with leucocytosis. Malnutrition, emaciation, spontaneous rupture, and occasional malignant degeneration may occur.†

The cause of reflex esophagitis is considered by some authors to be a relaxed or incompetent cardiac sphincter frequently associated with hiatus hernia.‡ However, the pathological changes may be induced by a variety of causes which are associated with vomiting, such as metabolic diseases, organic or psychic central nervous system diseases, moribund states, and ingestion of toxic substances as in alcoholism. In the last examples a caustic effect of the chemical may be an added trauma. Great stress has been placed on the importance of other primary gastrointestinal disease, especially peptic ulcer, cholecystitis, and more rarely appendicitis.[11] Benedict and Sweet reported 60 cases of benign stricture, 20 of whom had duodenal ulcer and 7 a history of gall-bladder diseases. Wangensteen and Leven feel esophagitis is a frequent manifestation of ulcer disease and mention the role of the short esophagus.[21] Chevalier Jackson found a focus of infection in the nose, sinuses, and pharynx present in 90% of patients with acute esophageal ulcer. An infectious cause is listed by Mason and Ausband from diphtheria or lymphatic extension of infection from a focus

*References 1, 3, 7, 8, and 13.

†References 24 and 3.

‡References 1 and 8.

in the thorax or abdomen.[13] However, the cause I would like to emphasize is esophagitis and stricture from the vomiting of pregnancy. P. P. Vinson was unable to find any reference to stricture associated with pregnancy prior to his review in 1921. Since then several such reports have appeared in the literature.§ Use of the inlying tube is occasionally reported as a cause.‖

Convincing cadaver and animal observation and experimentation have demonstrated that there is a causal relationship between the presence of acid-peptic contents in the esophagus and esophagitis and stricture (Bartels, Wangensteen and Leven, and Selye). Apparently hydrochloric acid alone is not nearly so destructive as gastric secretions. Bile or pancreatic secretion mitigates the effect.[7] Ferguson states that it is evidently the peptic activity, which requires a strongly acid medium, that is the important factor. Robins and Jankelson on fluoroscopy reported reflux of barium into the lower third of the esophagus in 103 patients, 59 of whom had some gastrointestinal pathology such as gall-bladder disease or peptic ulcer. They also observed reflux in 4.6% of patients examined in the prone position. Butt and Vinson in 213 cases of esophagitis seen at autopsy found a history of vomiting or passing a stomach tube in 46%. In 20% of the cases there was peptic ulcer, and in 23% chronic cholecystitis. Selye in 1938 produced hemorrhagic erosions in the rat esophagus by ligation of the pylorus. He found no esophagitis when both cardia and pylorus were ligated.

The symptoms are few: dysphagia, hematemesis, and retrosternal pain usually described as burning. Wangensteen and Leven stressed the importance of acid eructations and the tasting of food long after ingestion, in the interrogation of an ulcer patient.

The diagnosis is established by the above history with confirmation by x-ray and esophagoscopy. It is important to realize in viewing x-rays that food particles above the stricture may give the appearance of carcinoma. The importance in differentiating between stricture and carcinoma is obvious. Even in the well-prepared patient the x-ray diagnosis may leave much doubt, so that esophagoscopy and biopsy of any suspicious area and biopsy from deep within the lumen of the stricture is necessary. Occasionally repeated esophagoscopies may be needed to establish a diagnosis.

Fig. 1 (Case 1).—Complete obstruction of the lower esophagus.

REPORT OF CASES

Case 1.—D. C., a 37-year-old white woman, was nauseated and vomited with each of seven pregnancies, the first of which occured when the patient was 18 years old. The vomiting was progressively worse and lasted longer with each pregnancy. Since the last pregnancy five years prior to her hospital admission she had frequent nausea and vomiting. For the past year she had progressive dysphagia first for solids then for liquids. She had lost 35 lb. (15.9 kg.) and on admission she was completely obstructed.

Examination revealed that she was markedly emaciated and apathetic. Laboratory work revealed an anemia with hemoglobin of 7.5 gm. per 100 cc. The total proteins were 5.1%; albumin 3.2%, globulin 1.9%, and A/G ratio 1.7%.

§ References 10, 22, 23, and 25.

‖ References 3 and 8.

X-ray examination showed a dilated esophagus with marked smooth narrowing 2 in. (5 cm.) above the diaphragm, with total obstruction (Fig. 1). A scout film of the abdomen showed no gas in the intestinal tract.

Esophagoscopy showed a dilated esophagus, the lower end of which terminated abruptly in a blind end. Effort to locate the constricted lumen with the smallest Jackson dilator was unsuccessful.

Jejunostomy was performed for the preparation of the patient for resection of the strictured area since dilatation could not be begun. After the esophagus had been put at rest for three weeks she reported the sensation of fluid passing into the stomach. Reexamination by esophagoscopy revealed the constriction with scarred edges. Jackson dilators from No. 12 F. through No. 20 F. were passed through the stricture. After this, Hurst dilatations were begun and within two weeks a No. 46 F. Hurst could be passed without difficulty. The jejunostomy was closed, and the patient returned home, doing the dilations herself about weekly. She remained symptom-free for a year, returning when she was unable to pass her dilator and had begun vomiting. With help it was again easy to dilate the esophagus to an adequate caliber for relief of symptoms.

CASE 2.—A. B., a 62-year-old white woman, had a cholecystectomy in November, 1949. Postoperatively a Levin tube was used several days. On removal of this she was nauseated, vomited frequently, and said that swallowing required an unusual amount of effort. This improved somewhat until liquids would pass with some difficulty. The dysphagia then became gradually worse with regurgitation of fresh food and liquids. January, 1950, a program of dilatation was begun. She was hospitalized August, 1950, having lost 40 lb. (18 kg.).

Physical examination revealed an undernourished woman with evidence of slight cardiac enlargement. Laboratory work was within normal limits. X-ray examination (Fig. 2) showed three definite areas of constriction in the upper and middle thirds of the esophagus. The distal esophagus also appeared consistently narrowed, although it was difficult to determine if this was also stenotic because of the small amount of barium getting through the upper strictures.

Esophagoscopy revealed a short segment of dilated upper thoracic esophagus, about 2.5 cm. long. Below this the esophagus narrowed rapidly with scar tissue to a very high-grade stricture through which only the smallest (No. 10 F.) Jackson dilator could be passed. A gastrostomy was done and the continuous string placed through the esophagus and out the gastrostomy. Retrograde dilatations were carried out periodically and a 32 F. size obtained. With this she could eat a soft diet without difficulty. With infrequent self Hurst dilatations at home she has been able to keep herself overweight.

CASE 3.—V. F., a 23-year-old white woman, had a miscarriage, when she was eight months pregnant, that took 16 days to complete. During this time she was nauseated and vomited whenever she ate. After delivery she ate fairly well till the symptoms gradually returned, with regurgitation of fresh foods and even liquids. On admission to the hospital she had lost 30 lb. (13.6 kg.) and was regurgitating all feedings without nausea. She also complained of pain in the back on vomiting and a feeling of fullness in her throat and back.

Physical examination, except for emaciation, was not remarkable. X-ray examination of the esophagus with ingestion of barium meal revealed a stricture at the junction of the middle and lower thirds, and the esophagus was dilated above this. At esophagoscopy a stricture was encountered about 7 cm. above the cardia with a round but eccentric opening.

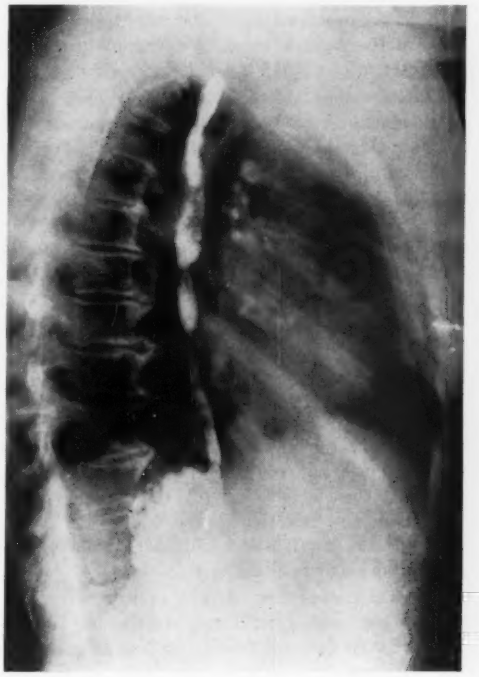

Fig. 2 (Case 2).—Series of strictures.

Repeated dilatations with Jackson dilators and the Plummer bag were carried out. After two of these she developed pleural effusion and pyothorax. Gastrostomy and drainage were done. Later after a series of many operations a functioning subcutaneous antethoracic esophagus was constructed of a skin tube.

CASE 4.—An 80-year-old white woman vomited dark brown sour material after a cholecystectomy. Her recovery was then uneventful till about two

weeks postoperatively, when she began regurgitating fresh food and complained of progressive dysphagia first for solids then liquids with discomfort localized to an area beneath the xiphoid process. There was a 12 lb. (5.4 kg.) weight loss.

Physical examination revealed a slightly emaciated woman with a dry loose skin. The chest showed slight emphysema and a few basilar rales clearing on coughing. The blood pressure was 230/80. There was a precordial murmur loudest over the mitral area. The abdomen, in addition to the cholecystectomy scar, revealed the liver palpable 8 cm. below the right costal margin. X-ray examination showed a stricture of the lower esophagus with tapering margins suggestive of an inflammatory lesion. However, in the right anterior oblique film there was a suggestion of a small overhanging margin.

Esophagoscopy showed a superficial white ulcer on the posterior wall about 37 cm. from the upper alveolar ridge in the distal third of the esophagus. The entire ulcer could not be seen because of a smooth annular constriction which prevented further passage of the scope. Jackson dilators from No. 10 F. through No. 20 F. were passed through the stricture. She was also placed on antiacids, antispasmodics, and Hurst dilatations. In 10 days she was able to eat a soft diet. There was no regurgitation following the first dilatation.

CASE 5.—N. M., a 55-year-old white woman, vomited several days following a thyroidectomy. At discharge she was eating solid food well two weeks postoperatively. About three weeks after the operation she noticed progressive dysphagia first for solids then liquids, and vomiting of fresh food. She had pain localized to the midthorax and a 21 lb. (9.5 kg.) weight loss when she was presented for treatment of this condition.

Physical examination showed evidence of recent weight loss, and a mild hypertension of 150/90. Indirect laryngoscopy showed pooling of mucus in the pyriform sinuses and prominence of the left ventricular band, which caused some dysphonia. X-ray examination showed a stricture of the lower esophagus with smooth tapering edges suggestive of inflammatory origin.

At esophagoscopy the thoracic esophagus was only slightly dilated. At 33 cm. from the upper incisors there was an annular constriction passing in a left anterior direction. The mucosa showed minimal erythema. The No. 10 F. through No. 22 F. Jackson dilators were passed. Hurst dilators were tried unsuccessfully. Gastrostomy and passage of the string was done for the use of retrograde Tucker dilators. The surgeon, feeling that carcinoma had not been adequately excluded, did a preliminary exploratory thoracotomy, but found the constriction of the upper part of the lower third was not hard and closed without further operative intervention.

The treatment is aimed primarily at keeping gastric juice out of the esophagus,[7] by removal of the various primary causative factors as in metabolic and central nervous system diseases, and peptic ulcer and gallbladder disease. Where this is not easy or possible a plea is made for effective use of antiacids. Here some of the new antinausea drugs, dimenhydrinate (Dramamine) and chlorpromazine (Thorazine), may be useful adjuncts to treatment.

If stenosis has occurred dilatation will be necessary. Use of the Tucker retrograde bougies and Hurst dilators, I believe, has considerable advantage over dilatation through the esophagoscope, over a string with the olive-tipped bougie, or the Plummer bag. The new indwelling hollow Tucker dilator seems promising. Attention to the patients nutrition is of great importance.

There are no doubt some indications for surgery. Friedberg and Clayton feel they are the following: failure of dilatation, recurrent hemorrhage, persistent pain, and esophageal perforation. At times, as is seen in Case 1, a gastrostomy affording complete rest of the esophagus is of great help.

SUMMARY

Esophagitis and stricture may result from recurrent regurgitation from a variety of causes. Symptoms, pathological findings, and methods of making a diagnosis are discussed. Vomiting from obstetrical and postoperative causes is emphasized in case reports. Because of the potential great disability the importance of early and effective treatment is stressed.

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Present State of the Surgical Treatment of Chronic Frontal Sinusitis

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and
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PREFACE

Chronic frontal sinusitis has been the subject of deep concern among physicians, so much so that a French professor has called it "the nightmare of the specialists."

Notwithstanding the antibiotics, surgery still plays an important part in the treatment of the infections of the paranasal cavities, and this is due to the fact that when acute inflammation has become chronic antibiotics are not effective.

The most important reason why an acute sinusitis becomes chronic is retention. Retention can be caused by something outside the sinus region, such as a deviation of the nasal septum, hypertrophy of the middle turbinate, nasal polyposis, and constriction of the nasofrontal duct. It can also be caused by something within the sinus, and among the latter causes one of the most important is the size of the sinus. Large sinuses very frequently show deep diverticula, partial partition, and retention cells.

The surgeon can act very easily in eliminating the first causes, that is, the ones outside the sinus; antibiotics can cure an acute infection and even a chronic one, but as long as the most important cause of retention persists, such as the size of the sinus with its diverticula and partitions, recrudescences and recurrences are frequently met.

It is in the large frontal sinus where suppuration more frequently becomes chronic, with the added complication that not only chemotherapy and antibiotics have very little effect but many times surgery fails to obtain permanent relief.

In view of the satisfactory results we have obtained in cases of frontoethmoidal maxillary sinusitis, we should like to describe a personal technique we have used with success since 1934. Our method has been the subject of several papers, but as our experience has increased we have introduced important modifications in the method.

A chronic frontal sinusitis is almost always a result of extension of a maxillary sinusitis through the ethmoid; therefore the infection of these cavities should be considered as one: frontoethmoidal maxillary sinusitis.

Some years ago we operated twice; the first time we did a Caldwell-Luc operation, and two weeks later we performed our operation on the frontal, ethmoid, and sphenoid sinuses, if necessary. At present we perform the two operations successively, in the same surgical act: We do first a transmaxillary ethmoidectomy according to the Ermiro de Lima technique, and immediately after we perform the operation on the frontal sinus. In cases of bilateral frontal sinusitis we operate on both sinuses at the same time, after the ethmoidectomy.

The first attempt at surgical treatment of a chronic suppurative frontal sinusitis should be endonasal, and its objective is to obtain good drainage of the secretions. This way we eliminate the extra sinus causes of retention.

But in spite of the existence of a patent nasofrontal duct most cases of sinusitis, especially in the large sinuses, remain in a chronic stage, and only an external operation can cure them.

Clinical Professor of Otorhinolaryngology of the Faculty of Medicine (Dr. Bergara). Assistant Professor of Pathological Anatomy of the Faculty of Medicine (Dr. Itoiz).

When we have a patient with chronic frontoethmoidal sinusitis who needs an external operation, we keep in mind: first, the treatment of the ailment itself; second, we think of the esthetic result of the operation; third, we try to avoid recrudescence and recurrence of the infection.

To treat effectively a frontal sinusitis we find it necessary to have a good exposure of the sinus cavity, its diverticula, and the anterior ethmoid. This is possible only through a large resection of the anterior wall of the sinus, which would allow the surgeon to see the depth, the diverticula, and the existence of one or more "bulla frontalis."

To obtain good esthetic results we use a personal technique which consists in making an osteoperiosteal flap, in which as much as possible of the anterior wall of the sinus should be included.* This flap offers a wide opening, which permits the control of the cavity of the sinus and its prolongations, and at the same time yields an excellent esthetic result.

Finally, the only sure way of avoiding recrudescence is, in our opinion, through obliteration of the sinus. We fill up the cavity, previously curetted and cleaned, with fatty tissue taken from the abdominal wall of the patient during the same surgical operation. This autograft, transplanted inside the sinus, attaches itself to the osseous walls, completely fills the cavity and its prolongations, and finally undergoes a partial fibrous transformation. This method of obtaining obliteration of the sinus is based on experiments made by us on frontal sinuses of dogs, the results of which were presented to the "Sociedad Argentina de Oto-rino-laringologia" (Argentine Otorhinolaryngological Society).†

The results of the first cases of transplantation of fatty tissue into the frontal sinuses of patients were presented to the Second Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology, which was held in Montevideo, Uruguay, in January, 1950.[28]

A. DESCRIPTION OF THE TECHNIQUE

We shall describe the present surgical procedure, the result of several successive modifications.

The eyebrows are cut as much as possible with scissors, and the corresponding nasal fossa is tamponed with gauze moistened with a solution of cocaine-epinephrine. Local and regional anesthesia is administered with 2% procaine hydrochloride and epinephrine.

Fig. 1.—Incision of the skin and subcutaneous tissue only (*1*). Incision of the periosteum and osseous incision (*2*). These are made little by little, first periosteum and then the osseous.

Incision of the Skin.—The incision of the skin is made in the middle of the eyebrow and extends, laterally, from the external limit of the sinus to 1 cm. under the head of the eyebrow, medially. This incision includes the skin and the cellular subcutaneous tissue only. The superior lip of the incison is undermined to a little beyond the peripheral limits of the affected sinus. This generally causes considerable bleeding. Hemostasis is effected by tying the main vessels and by diathermocoagulation of the smaller ones.

* References 3, 15, and 19 to 21.

† Bergara, A. R., and Itoiz, O. A.: Experimental Study of the Behavior of Adipose Tissue Within the Frontal Sinus of Dog, presented to the Argentine Otorhinolaryngological Society, 1951.[27]

Fig. 2.—Explorer used in determining the convenient points for trephining.

Fig. 3.—Several perforations are made 6 to 8 mm. from each other, as near as possible to the periphery of the sinus.

Exposure of the Frontomaxillary Suture.—An incision into the periosteum is made for about 1 or 1.5 cm. at the internal end of the wound, and the periosteum elevated from one side to the other, enough to locate the above-mentioned suture to determine the point for the first trephine, which should be 3 to 4 mm. above the frontomaxillary suture.

The Osteoperiosteal Flap.—With a round motor-driven burr approximately 3 mm. in diameter, similar to the ones used by dentists to prepare cavities in teeth, an exploratory trephine opening is made in the spot mentioned above. As soon as the burr starts working, we start an almost continuous irrigation of the surgical field with an isotonic sodium chloride solution, and at the same time aspirate and collect the secretions and bone dust produced by the burr.

The most internal part of the sinus is explored with a small curved probe, which is nothing more than the instrument used by dentists to find cavities in teeth, and known by the name of dental explorer or broach. This explorer is introduced through the trephine opening and turned from side to side, serving to guide us in determining the more convenient point, as near as possible to the periphery of the sinus for the second trephine. Then the periosteum between the initial trephine and the place chosen for the second is incised, but only as far as the site of the second trephine.

In this way we make several perforations 6 to 8 mm. apart, and as near as possible to the periphery of the sinus, until we reach within 1 cm. of the superior orbital rim. With a linear burr 1 mm. in diameter we link the perforations and sever the orbital rim at the most external and internal ends of the incision. This osseous incision should be beveled so as to afford good contact when the osteoplastic flap is returned to its original site at the end of the operation, avoiding in this way any possibility of its collapsing into the sinus. The inferior, or orbital, wall of the sinus is very thin and therefore very fragile, so that by applying two flat instruments through the osseous incision it is very easy to fracture it.

Fig. 4.—The perforations are linked by an osseous incision, which will be beveled.

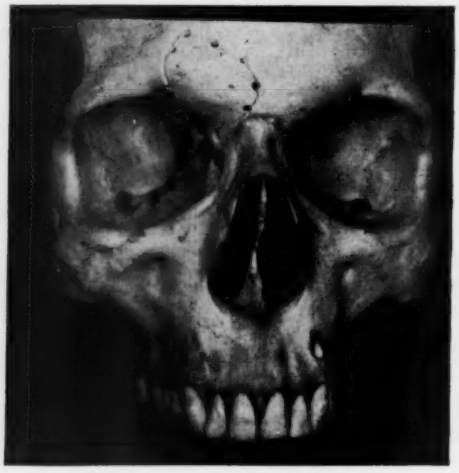


Fig. 5.—Photograph shows how the osseous incision is beveled.

This procedure gives us an osteoperiosteal flap, hinged on its lower side, which offers a wide exposure of the frontal sinus when it is reflected downward. Once the cavity is open, it is cleaned with an abundant warm saline irrigation and suction.

The Mucous Membrane of the Sinus.—Without any doubt, a frontal sinusitis that requires an external surgical treatment involves a diseased mucous membrane, which therefore has to be resected, despite its appearance. We should not forget that the hyperplastic mucous membrane very often hides diverticula and foci of osteitis. Not only is a very careful extirpation of the mucous membrane indispensable but also a moderate curettage of the osseous walls must be done.

If there is any "bulla frontalis" which projects into the floor of the sinus, it should be opened, its mucous membrane resected, and its cavity merged into that of the sinus.

Resection of the Anterior Ethmoid.—The sinus having been cleaned, the surgeon can now evaluate the result of the transmaxillary ethmoidectomy, in case the patient had this operation performed before. One may still have to do what the transmaxillary ethmoidectomy frequently fails to do completely, namely, resect the most anterior cells.

Fig. 6.—By inserting a couple of retractors through the bone incision, it is quite easy to fracture the orbital wall of the sinus.

Fig. 7.—The sinus having been cleaned, a curved metal probe is passed through the nasofrontal canal to locate its direction.

A curved metal probe is passed through the nasofrontal canal to locate its direction. Then with adequate curved curettes and small cutting forceps, moving up and down and vice versa, the "agger-nasi" cells and the cells surrounding the nasofrontal and lacrimous-nasal canals will be resected.

The pulley of the superior oblique is not affected; therefore we do not have to fear a postsurgical diplopia.

Transplantation of the Fatty Tissue to the Sinus.—Since July, 1949, we have not provided drainage from the sinus into the nasal fossa. We do not need it, since we fill the sinus with fatty tissue taken from the abdominal wall of the patient.[28] The tissue is cut into small pieces, but one of them should be large enough so that it can be fitted with a little pressure into the upper end of the widened nasofrontal canal, taking care that it does not slip into the nasal fossa. Smaller pieces are carefully adapted to the periphery of the sinus and with the others the rest of the cavity will be filled, but the last pieces should be inserted loosely, without pressure.

If we wish to avoid the procedure of taking fat from the abdominal wall of the patient, we can employ fatty tissue obtained from a "fatty tissue bank." ‡ This bank is formed with material obtained in operating on a "fatty tissue apron," which is later cut into pieces of about 4 by 4 by 4 cm., then washed and put into wide-mouthed bottles containing isotonic sodium chloride solution. These should then be placed in the autoclave for five minutes, after which they can be kept at room temperature until needed.

‡ Bergara, A. R., and Itoiz, O. A.: A New Manner of Postsurgical Obliteration of the Frontal Sinus, read before the Argentine Society of Otorhinolaryngology, Sept., 1953.

Fig. 8.—Only if we judge necessary, we remove the upper part of the maxillary process and part of the lacrimal bone.

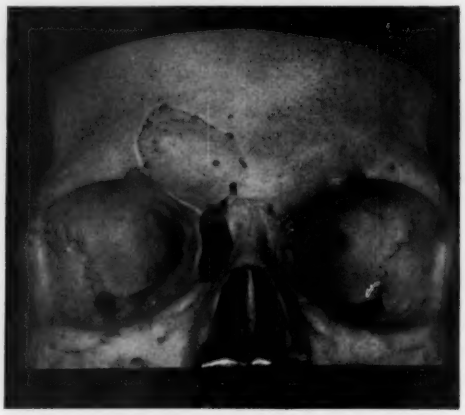


Fig. 9.—After a careful extirpation of the mucous membrane and ethmoidal cells, the sinus is filled with fatty tissue, the flap is secured against the frontal bone by several sutures in the periosteum.

Application of the Flap and Suture.—The flap is secured against the frontal bone without fear of its collapsing into the sinus because of the disposition of the bevel edge of the osteoplastic flap. Several sutures in the periosteum will keep it in place. The eyebrow is closed with an intradermal suture and interrupted stitches, if necessary. A capillary drain may be left in the internal angle of the incision, and can be removed the following day.

B. POSTSURGICAL OBLITERATION OF THE FRONTAL SINUS

There are several ways of obtaining the postsurgical obliteration of the frontal sinus.

First Method.—Make a flap of the soft parts, resect the anterior wall of the sinus, and let the large cavity fill up from the bottom to the surface. After several weeks suture the flap.

Second Method.—The classic example of this second way is like the one practiced by Kuhnt for the first time in 1894. He made a skin flap, resected the anterior or both the anterior and inferior walls of the sinus if he thought it necessary; after curettage of the cavity he sutured the flap back. The oblitera-

tion was obtained by plastering the soft tissues against the posterior wall of the sinus. Both procedures were abandoned owing to their being extremely mutilating.

Third Method.—Postsurgical obliteration of the frontal sinus may be done by the simple removal of the mucous membrane from the sinus. The oldest report we know of on the experimental postsurgical obliteration of the sinus is the one that Samoilenko [1] published in 1913. He experimented on cats and dogs and reached the conclusion that the sinus which is deprived of its mucous membrane through surgery suffers an osteofibrous obliteration, disappearing as a cavity.

In 1914, Moure [2] observed the decrease in size of the maxillary sinus in a patient who had to be operated on again, and he agrees with Samoilenko in reference to the natural tendency of that cavity toward obliteration after resection of the mucous membrane.

Since then several American authors have become interested in observing the evolution of a sinus which is deprived of its mucous membrane. Knowlton § and McGregor || have studied experimentally the regeneration of the mucous membrane of the maxillary sinus of the dog, reaching the conclusion that regeneration is produced after a certain limit of time. The work of Coates and Ersner [7] is more important, since the authors experimented with the frontal sinus of the dog, reaching the conclusion that there is no obliteration but rather a regeneration.

Other researchers have studied the evolution of the sinus in patients who have had an operation on the maxillary sinus, and have controlled the regeneration of its mucous membrane through successive examinations with an antroscope and biopsies made at different times.

The truth is that there is no complete agreement on whether there is partial obliteration, total regeneration, or only a fibrous membrane that covers the walls of the sinus.

§ References 4 and 10.

|| References 8 and 9.

As for our experience, we have on several occasions removed the mucous membrane of the frontal sinus of dogs. In the autopsies we found the cavity smaller in size due to the fibrous membrane that covered the walls as well as a thickening of the walls due to new bone formation.

It is our opinion that what happens inside a sinus that has been deprived surgically of its mucous membrane is as follows: The Haversian canal systems contain fibrocytes, osteoblasts, some adipose cells, vessels, and nerves. When the mucous membrane is removed, the fibrocytes proliferate and are transformed into fibroblasts in an effort to repair the damage, and they form together with the fibrin, the osteoblasts, and the newly formed vessels an irregular membrane which covers the walls of the sinus.

As the fibroblasts proliferate, the membranous coat becomes thicker until the epithelium, which comes from the neighboring regions, in this case the nose, covers it. Along the osseous walls, the osteoblasts develop an osteoid tissue and a more or less thick coat of osseous tissue. Finally the cavity persists, even though smaller in size.

Fourth Method.—The obliteration of the cavity through implantation of foreign substances, such as pastes, acrylics, etc., has been abandoned. In truth, those substances do not adhere to the osseous walls, and many times they lead to foreign-body reactions.

However, the obliteration of the sinus through implantation of tissue has proved effective. We have said before that since July, 1949, we have filled up the sinus with an autograft of adipose tissue, having been the first to do so. This tissue inside the sinus cavity acts as a net through which the fibroblasts develop and reach the opposite wall of the sinus, forming a conglomerate which is organized and occludes the cavity. This is possible because the fibrous, the adipose, and the osseous tissues are connective tissues, while the nasal epithelium cannot pass

through the fatty tissue because it belongs to another layer of blastoderm.

In June, 1953, we used a mixed implant formed by the adipose tissue sterilized in the autoclave, and a blood clot.¶ This procedure for obliteration was tried first in dogs, and autopsies of the animals showed that this mixed type of implant obliterated the cavity very well, with less postsurgical reaction and much faster organization. The histopathological study of these experiments is not yet finished.

The experimental results led us to perform the operation on five patients with chronic suppurative sinusitis, with excellent therapeutic and esthetic results. In the patients, as in the animals, the postsurgical reaction was minimal and recovery was faster than when we used fatty tissue alone. As we have not had the opportunity of operating again on any of the patients, we do not know the histopathological evolution of the mixed implantation in a human frontal sinus.

Drs. Tato, Sibbald, and Bergaglio [26] have attempted to modify our method, but without improving it. The use of the "grille" or the "bronchoscopic lamp" to determine the size of the sinus and the use of the Tato burr for the osseous incision, even though theoretically useful, have very little practical value. The treatment of the bilateral frontal sinusitis by trephining only one of the sinuses is not advisable. It is contrary to the principle already established that, to obtain a complete cure of the sinusitis, the surgeon has to be sure of controlling all the diverticula of the sinus, which he cannot do through the intersinus opening.

In the cases of bilateral frontal sinusitis, we advise trephining simultaneously both sinuses.

C. EXPERIMENTAL HISTOPATHOLOGICAL CONSIDERATIONS JUSTIFYING POSTSURGICAL OBLITERATION OF SINUS THROUGH IMPLANTATION OF TISSUES

I. EXPERIMENTS ON FRONTAL SINUS OF DOG

When we thought of making these experiments we had several doubts.

The first one was about the reduction of the volume, which, according to Gurney,[18] is undergone by the fatty tissue when implanted under the skin. If this happens in the frontal sinus, we would fail in our attempt to occlude the cavity. The second one was to know if the autograft was vitalized when implanted on an osseous tissue which normally is covered by a mucous membrane, such as is the frontal sinus. These doubts were solved by us through experiments made in 31 dogs. In all of these we had similar results, two of which we present in this paper.

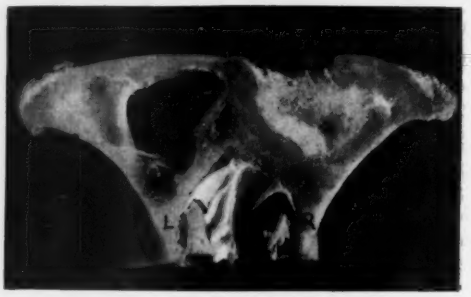


Fig. 10 (P. 16).—Implantation of the boiled fatty tissue, after 75 days of evolution. Frontal section, anterior segment.

Experiment P. 16.— This was a dog whose frontal sinus was operated upon. After thorough removal of the mucous membrane the fatty tissue, which had been boiled in an isotonic sodium chloride solution, was implanted.

Autopsy was done 75 days after the operation.

Macroscopically the implanted tissue (Fig. 10) appeared lardaceous and firm, with a grayish color and with all the normal characteristics of adipose

¶ Coates, G. M.: Personal communication to the authors. Coates calls attention to the "blood clot method," introduced by Sprague, of Rhode Island, for the obliteration of the bony cavity caused by a simple mastoidectomy. This was popular during the early years of the 20th century, and endorsed by Blake, of Harvard, and Reik, of Johns Hopkins. The method consisted simply in filling in the carefully cleared mastoid excavation with fresh blood and suturing the wound without drainage. Coates employed this method in a few frontal sinus cases, with great satisfaction, but did not use the osteoplastic flap, and his experiences were not published.

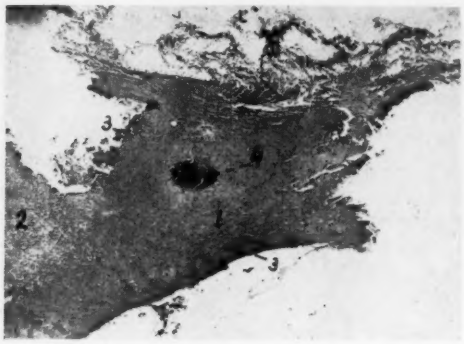


Fig. 11 (P. 16).—Panoramic microfilm of the extracted graft 75 days after the operation. Dense fibrous tissue (*1*), osteoid tissue (*2*), peripheral osseous trabecula (*3*), central osseous trabecula (*4*).

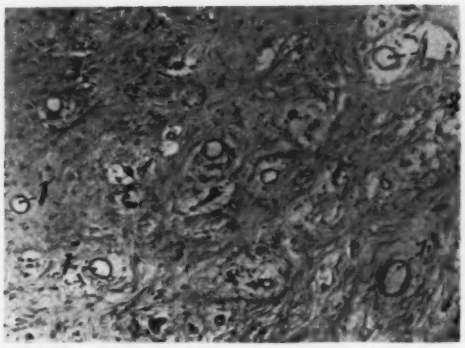


Fig. 13 (P. 16).—Microfilm greatly enlarged showing a more developed part of the osteoid tissue. Newly formed vessels (*1*), loose connective tissue (*2*), osteoid trabecula (*3*).

tissue having disappeared. The bony walls of the sinus were thickened by an osseous neoformation, mostly in the lower portion. The fibrous transformation of the implant can be observed in the microfilms (Figs. 11 and 12). One can see how the implant fills the cavity completely and is firmly attached to the walls of the sinus.

The microscopic study of the extracted implant showed that it had undergone a dense fibrous evolution, with replacement of the celluloadipose tissue by a hyaline connective tissue. In some parts of the fibrous tissue (Fig. 11) one may observe clearer and more uniform zones, whose histological details can be made out in the following microfilms. In the center of the section there is a formation which if studied under magnification will be shown to be an osseous trabecula formed in a zone away from the walls of the sinus.

The following microfilm (Fig. 12) corresponds to a part of zone 2 in Figure 11. One can see a loose connective tissue, forming a clear mesh centered by vessels. Surrounding this zone, the connective fibers are condensed and have taken an osteoid aspect. This is called by Professor Policard "preosseous edema." In Figure 13 one can seen the tendency toward the formation of Haversian canal systems.

Figure 14 shows the structure of the osseous trabecula found in the center of the section. The trabecula is surrounded by a crown of osteoblasts right in the period of ossification. At the same time the osteoblasts are surrounded by a zone of osteoid tissue.

Experiment P. 21.—This was a dog whose frontal sinuses were operated on at the same time, but the sinus on the right side was filled with fresh fatty tissue; that is, we used a direct autograft, while in the sinus on the left side, we used an implant of adipose tissue boiled for five minutes in isotonic sodium chloride solution.

The autopsy was done three months after the operation. The sinus cavity of the right side maintained its original dimensions. The autograft had

Fig. 12 (P. 16).—Zone 2 of Figure 11 greatly enlarged.

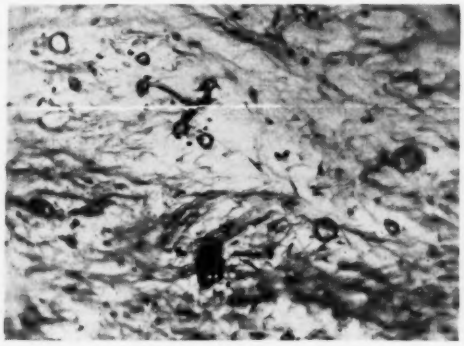
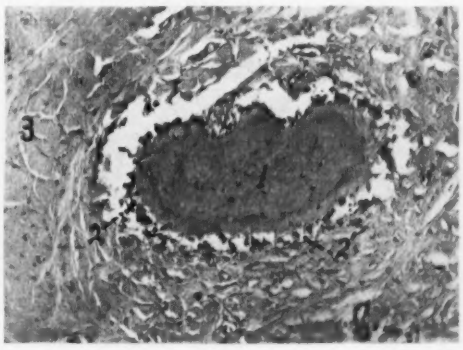


Fig. 14 (P. 16).—Microfilm greatly enlarged showing the central osseous trabecula of Figure 11. Osseous trabecula (*1*), osteoblasts chain (*2*), osteoid tissue (*3*).



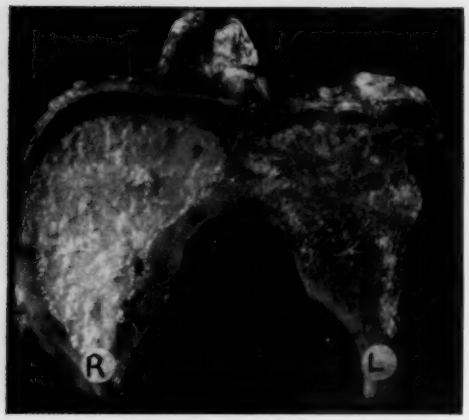


Fig. 15 (P. 21).—Frontal section, anterior segment. *R*, right sinus with autograft of adipose tissue; *L*, left sinus filled with adipose tissue previously treated by boiling it. Both after three months of operation.

the aspect of normal adipose tissue. A connective-tissue capsule with a thickness of 1 mm. fixed it to the osseous walls. The fatty tissue maintained its yellow color and its bland characteristic consistency. There were no zones of fibrosis or hemorrhages. In general its appearance was that of a large fat cell of a spongy bone, that is, as though it were adipose bone marrow.

On the contrary, the left sinus had a grayish color and a firm consistency. In the central part there was fibrous tissue that looked like a scar, and in the periphery the density corresponded to the osseous tissue in such a way that it was difficult to indicate precisely which was the wall of the sinus. This was more evident when the implants were removed for histopathological study. Figure 16 gives a clear idea of the decrease in size of the left cavity.

Figure 17 is that of a microfilm of the implant from the right sinus greatly enlarged.

Fig. 16 (P. 21).—Another section of the same animal in which we tried to extract the implant for a histopathological study. Note the extraordinary osteogenesis that occurred in the left sinus.

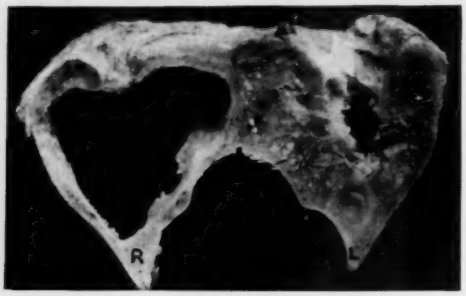


Fig. 17 (P. 21).—Section of the autograft of the right side greatly enlarged. One may observe adipose vesicular cells with their nuclei conserved, collagenous septa, and a delicate fibrillar reticulum.

The results obtained from these experiments, which are similar to all the other ones we made on the same subject, allowed us to conclude that the autograft is preserved and vitalized without tissue substitution; but the adipose tissue that had been boiled suffered on osteofibrous transformation. As may be seen, the adipose tissue appears to satisfactorily obliterate the frontal sinus, previously deprived of its mucous membrane. It fills it completely and adheres to its walls. There is no contraction of the implant, as Gurney observed, when the implant is placed under the skin.

II. Observations on the Frontal Sinus in Patients with Chronic Suppurative Sinusitis

The experiments made in animals did not give the entire solution to some important

Fig. 18 (P. 21).—Section of the extracted implant from the left sinus. One may see collagenous septa crossed in every direction, some residual adipose vesicular cells, and zones of loose connective tissue formed by the "preosseous edema" of Policard.

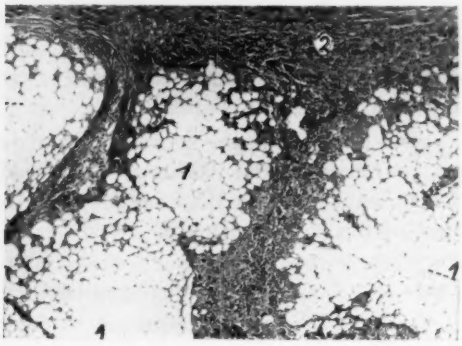


Fig. 19 (J. T.).—Microfilm of the autograft extracted 50 days after the operation. It corresponds to a zone away from the infection. Small islands of vital adipose tissue (*1*) and granulation tissue which will develop into fibrous septa (*2*).

points. The first one was what would be the evolution of the implanted adipose tissue in a suppurating sinus which, even though it had been curetted and cleaned, was still a septic cavity. The second was how would this tissue, which, according to general opinion, is an easy prey to purulent infections, react if a new infection took place in its vicinity. The answers have been given in 34 cases in which operation gave good results, as illustrated by the two following cases:

Case 1.—A man of 50 years of age presented a frontoethmoidal sinusitis in the left side with orbital complications on the same side. We performed an operation following Professor Bergara's technique, with an autograft of adipose tissue taken from the abdominal wall of the patient. Progress was good until the 10th day when pus appeared at the inner end of the wound. The patient was given large doses of antibiotics, but the infection did not subside. Forty-six days after operation, the orbital complication reappeared, and we decided to operate again.#

Fig. 20 (J. T.).—Microfilm of the autograft of the zone corresponding to the abscess. Small island of adipose tissue well preserved (*1*) and granulation tissue with polynuclear infiltrates (*2*). This reaction does not have a tendency to eliminate itself; on the contrary, it tends to organization. This process could have been cured simply with good drainage of the abscess cavity. Small purulent collection (*3*).

During the operation we found that the osteoperiostic flap adhered well to the frontal bone by a dense fibrous tissue, and presented a fistula at its internal end. The flap was taken off, disclosing the autograft filling the sinus cavity and its diverticula completely, but at its most internal part, in the ethmoid region, there was a small abscess originating in a diseased ethmoidal cell, which had been overlooked in the first operation.

Macroscopically the adipose tissue transplanted 50 days previously, in spite of the prolonged contact with the pus in the abscess, not only had resisted the infection but had remained vital.

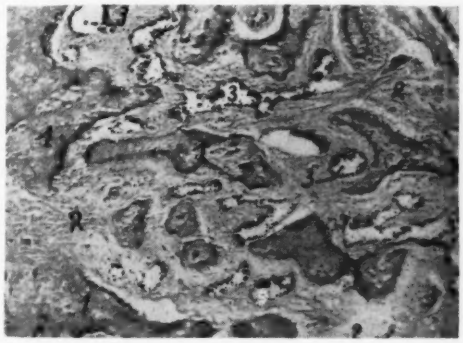


Fig. 21 (J. T.).—Microfilm of the osseous operculum. Osseous trabeculae (*1*), medullary spaces (*2*), blood capillaries filled with red corpuscles (*3*).

Taking advantage of the opportunity, we resected the flap and all the autograft for the histopathological study.* Some of the microfilms are repro-

Bergara, A. R., and Itoiz, O. A.: Histopathological Study and Behavior of the Autograft of Adipose Tissue in a Chronic Frontal Sinusitis with Recrudescence, read before the Third Argentine Congress of Otorhinolaryngology, Cordoba, Argentina, Oct. 9, 1952.[29]

* Bergara, A. R., and Itoiz, O. A.: Histopathological Behavior of the Adipose Tissue Transplanted in the Frontal Sinus in Cases of Chronic Suppurative Sinusitis, read before the Fourth Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology, México, D. F., Mexico, Feb. 28-March 4, 1954.

duced in Figures 19, 20, and 21. As can be observed, the osseous trabeculae were well constituted and the marrow spaces were well filled with vessels containing red corpuscles, demonstrating their vitality.

CASE 2.—This case is as illustrative as the first one. On a man of age 46 years for the first time we made an autograft of adipose tissue in the sinus cavity. In July, 1949, he had a chronic frontoethmoidal maxillary sinusitis on the left side with an external frontal pneumatocele of the same side. X-ray examination showed that also the right frontal sinus was somewhat cloudy, and we suspected that it was infected.

On the left side we performed a transmaxillary ethmoidectomy, followed immediately by the frontal sinus operation according to our technique, with an autograft of adipose tissue taken from the abdominal wall of the patient. The results, therapeutic as well as esthetic, were excellent.

Four years later, in August, 1953, the right frontal sinus showed an evident suppurative sinusitis; therefore we decided to operate following the same technique. During the operation we found pus and fungus in the cavity and the intersinus septum partially absorbed due to the infection. We enlarged the perforation in the intersinus septum, and through this opening we took a biopsy specimen of the adipose tissue transplanted four years before. We finished the operation with an implant, but this time the adipose tissue was taken from an "adipose tissue bank." The therapeutic and esthetic results were similar to those at the first operation. On this occasion besides the horizontal incision in the eyebrow we made a vertical incision of débridement of fibrous tissue to facilitate taking the biopsy specimen and to observe the state of the implantation in the left sinus. This implant completely filled the cavity and was firmly attached to the osseous walls. In spite of having been in contact with the infection in the right sinus, it did not appear to have been involved.

The microscopical study showed the existence of small islands of adipose tissue well vitalized, partial fibrous transformation, and at some points zones of osteoid tissue.

These two clinical cases have the value of an experimental test which shows the following:

1. The autograft of adipose tissue is vitalized in spite of its being transplanted to a septic cavity; it completely fills the sinus and diverticula, not only for the mechanical reason of its presence but also because of the proliferation of fibrous tissue coming from the osseous walls. 2. It resists infection the same as any other connective tissue and with appropriate medical treatment tends to organize, and not to eliminate itself.

With reference to the mixed implantation in the frontal sinus of the patients we would like to say that we can judge only the clinical-therapeutical results, not having had the opportunity to reoperate on any of these patients to make the histopathological studies.

Since 1934, using our technique, we have operated on 104 patients, and in every one of them, with the exception of 2, we have obtained very good results.

In 70 cases we left a drainage tube in the nasofrontal duct. Among these cases, 22 were operated on before the chemotherapeutic and antibiotic era, and the other 48 before July, 1949.

In 34 cases, many of them with bilateral frontal sinusitis, we did not leave any drainage to the nasal fossa, but filled the sinus cavity with implantations of tissue:

- 20 with adipose tissue taken from the patient (autograft)
- 9 with adipose tissue taken from a "fatty tissue bank"
- 5 with mixed implantations formed by adipose tissue from a bank and a blood clot formed by blood taken from the vein of the patient before the operation

We have had to reoperate in two cases: one at the beginning of our practice because inadvertently we left a bit of the mucous membrane, which subsequently developed a mucous cyst; the other case is Case 2 described above.

CONCLUSIONS

Even though in our country and several South American countries our procedure is used with satisfactory results, we would like to draw conclusions based solely on our own results:

1. There is no reason of a technical nature why a chronic frontal suppurating sinusitis cannot be cured.

2. Our osteoplastic technique should replace all the other methods in which perma-

nent osseous resections are done. It is indicated also in cases of doubtful or latent sinusitis, since there is no fear of a deforming scar.

3. The obliteration of the sinus cavity is a guarantee against recrudescence and relapse, and the implantation of adipose tissue is well tolerated, fills the cavity, and resists the infections of the neighboring cavities. It also seems to have a beneficial action in the cure of the process. We do not know up to what point the tissue therapy of Filatow could have any influence on these observations.

4. We have the impression that with transmaxillary ethmoidectomy, as advised by Ermiro de Lima, with our technique, and filling-up the sinus with adipose tissue—all done at one sitting—unilateral chronic suppurating pansinusitis could disappear as the "nightmare" of the specialists.

5. Undoubtedly the results mentioned have been obtained through the very valuable assistance of the antibiotics.

Hipolito Irigoyen 1780.

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Current Medication in Otitis Externa

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It has been said that medicine is not an exact science. There are many infections, however, in which specific forms of treatment give excellent results. This is not the case when dealing with infectious otitis externa. Patients treated for this condition respond at times quite differently. Some clear up within a few days under one form of treatment, while others with apparently the same type of infection and the same therapy progress and get steadily worse. As a result, numerous drugs have been used over the years for their bactericidal or cauterizing effect, and recently the antibiotics have been prescribed locally as well as by injection. The fact that so many remedies have been suggested shows that none of them are really effective in all cases.

Until World War II it was generally considered that the etiologic factor was mainly a fungus infection and that bacteria were of secondary importance. During the war and immediately after, it was shown that the vast majority of cases of infectious otitis externa were bacterial in origin and that fungi played a minor role. It is now thought that at least 85% are caused by bacteria and perhaps 15% or less by various fungi.

Increased interest in the subject and improved bacteriological studies, especially in the South Pacific, were responsible for this revision of thought.

It has been estimated that between 5% and 40% of patients seen by the average otolaryngologist seek advice for external otitis. This percentage varies from season to season and in different parts of the country.

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In the tropics and below the equator it is endemic and at least 50%-60% of the patients complain of this condition. The temperate climates are not immune, as otitis externa is frequently seen in Canada, especially in the summer months following swimming.

During the winter months otitis externa is also troublesome and at times very resistant to treatment. Overheated houses without proper humidification tend to dry the skin, and in certain persons this causes intense itchiness. In seeking relief for the irritation, the patient excoriates the skin surface of the ear canals and opens the pathway to infection.

Cultures from cases of diffuse external otitis show the Pseudomonas aeruginosa to be the chief offender, followed by other Gram-negative organisms. In relatively few ears Gram-positive bacteria are cultured, such as Staphylococcus aureus and albus or nonhemolytic Streptococcus. Although some of the newer antibiotics are effective against many Gram-negative organisms and most of the Gram-positive ones, Pseudomonas (Bacillus pyocyaneus) seems to be the exception. At the present time there is no specific form of treatment when the offending organism is Pseudomonas or Proteus vulgaris.

A few words about the skin of the external auditory canal might be in order. The outer one-third of the canal consists of a membranocartilaginous base continuous with that of the auricle, while the inner two-thirds is bony. In the outer third numerous hair follicles are found in association with many sebaceous and ceruminous glands. These glands which pour their secretions on to the surface are absent in the bony meatus. It has been shown that normally these secretions are on the acid side and that when there is an upset

in skin physiology there is a shift to the alkaline side.

A little knowledge about the reactions of body fluids is important. In recent years the pH, or hydrogen-ion concentration, has been carefully studied. The pH scale is widely used today and is a means of expressing hydrogen-ion values. For practical purposes the range of the pH scale is between 0 and 14. The center of the scale is 7, the pH of pure water. This is the true neutral point. All values below pH 7 show an increased hydrogen-ion concentration, or an acid reaction, while values between 7 and 14 indicate an alkaline reaction. The pH of the skin of the external ear canal has been studied by a number of investigators.* In adult male and female patients the pH range was found to be practically the same, from 5.0 to 7.8, i. e., on the acid side of the scale. A group of male and female infants showed similar results, apart from slight variations. In view of these facts many competent observers feel that patients are more susceptible to infection by bacteria if the normal acidity of the external meatus is replaced by an alkaline reaction. In commenting on the acidity of the skin, Wise and Sulzberger [3] wrote:

> These results confirm the fact of the normal acidity of the skin surface and the old-accepted concept of the protective function of the acid mantle. The logical conclusion, in managing many skin diseases, is, therefore, not to "alkalinize" but rather to "acidify"—at least as regards the skin's surface. Experimental data show not that there is "too much acid" but rather that there may be too little acid on the skin surfaces in many instances of cutaneous infection and disease.

In other words, speaking generally, clinical experience has shown that alkalis are much more likely to produce severe and persistent damage to the skin than acids.

Since the advent of chemotherapy all the available agents have been used both locally and systemically, with varying degrees of success. Theoretically, at least, an antibiotic should be nonirritating and nontoxic when applied to the skin and still be effective against a wide range of bacterial and fungal infections. Unfortunately, the ones currently at our disposal are not entirely satisfactory when otitis externa is concerned.

According to Singer and associates,[4] who examined 1377 normal ear canals, over 90% contained hemolytic or nonhemolytic staphylococci. In external otitis with a mixed type of infection the percentage of staphylococci dropped down to only 25% due to the overgrowth of secondary Gram-negative organisms.

In normal ears only 1% showed Pseudomonas (B. pyocyaneus) on culture, while in over 65.5% of infected canals this group of organisms was isolated. Until about 10 years ago, as mentioned at the beginning of this paper, most cases of external otitis were thought to be fungoid in nature and were described under the general term of otomycosis.

It is now thought that less than 15% are due to a fungus infection, which is relatively unimportant in normal canals but is often troublesome when the canals are infected. Of all the mycotic infections, Candida (Monilia) and Aspergillus were by far the most frequently found. In otitis externa, Pseudomonas was the commonest and most constant cause of infection. The other Gram-negative rod most frequently present was P. vulgaris. When otitis externa was associated with Gram-positive organisms, the one most often isolated was Streptococcus.

Otitis externa of fungus origin may occur by itself or be accompanied by bacteria. The secondary organisms most frequently found in association with fungi are Gram-negative bacilli and only rarely streptococci.

In view of the fact that over 65% of cases of external otitis are due to Pseudomonas alone or in combination with some form of Streptococcus, one single drug would not appear to be sufficient.

Of all the antibiotics, oxytetracycline (Terramycin) by mouth would seem the most effective to get rid of the Gram-negative rods, and sulfadiazine or triple sulfonamides to take care of the Gram-positive streptococci, according to these writers. As an alternative

* References 1 and 2.

chlortetracycline (Aureomycin) has been suggested.

In a small series of cases of external otitis Wright [5] found chlortetracycline to be the drug of choice in treating P. aeruginosa. He used it locally in the form of powder after cleaning the ear canal. At times he combined it with streptomycin. Theoretically, at least, according to many eminent bacteriologists, other agents are more beneficial.

Another article, by Gill,[6] in the same issue of the ARCHIVES suggested that dibromosalicylaldehyde (Dalyde) and 4-aminomethylbenzenesulfonamide hydrochloride (Sulfamylon), 5%, with streptomycin were perhaps the most useful drugs against Pseudomonas.

Solutions of Sulfamylon as low as 1% have been shown to destroy many Gram-positive and Gram-negative organisms, including B. pyocyaneus. It is a white crystalline powder, soluble in water, and is slightly acid in its reaction. Brewer [7] found that it had greater bactericidal properties than sulfadiazine or sulfathiazole. It can also be given orally, subcutaneously, or intravenously, without ill effect.

In an article published in 1952 Diehl [8] concluded that "sulfamylon is an effective local therapeutic agent in external otitis." It should be considered as a valuable adjunct in the local treatment of external otitis, either acute or chronic.

Although Pseudomonas, S. aureus, alpha and beta hemolytic streptococci are the usual bacteria found in external otitis, they also are the ones most frequently encountered in chronic otitis media, at times associated with Klebsiella pneumoniae. Because of this uniformity of the bacteriologic findings and the effectiveness of Sulfamylon, it would appear unnecessary clinically to take cultures except on rare occasions.

After carefully cleansing the canal of pus or debris, the patient's head is tilted to the side so that the affected ear is turned upward. Four or five drops are instilled into the canal and the patient asked to remain in that position for a few minutes.

After drying the ear, the patient is instructed to carry out this procedure three or four times a day at home. (It might be mentioned that in chronic otitis media this same treatment is advocated after inflation. This is done in order to get rid of any tubal discharge.)

Experience has shown that many cases of external otitis respond that had resisted other forms of therapy. Sulfamylon in solutions from 1% to 4% seemed equally effective, although the weaker solutions required a longer time. In some people the 4% solution causes a burning sensation, especially if the ear canal is raw and inflamed. A 5% solution of Sulfamylon containing ethyl aminobenzoate (Benzocaine) in propylene glycol is now available. It appears to be an improvement, as the ethyl aminobenzoate relieves any discomfort and the propylene glycol acts as a wetting agent, allowing greater penetration. The pH is between 4.5 and 5.0.

In a recent series, a number of cultures of P. aeruginosa were tested for sensitivity to seven agents currently used in external otitis. The drugs used were Sulfamylon, chloramphenicol (Chloromycetin), oxytetracycline, dihydrostreptomycin, streptomycin, penicillin, and bacitracin. Of this group, Sulfamylon was by far the most effective, chloramphenicol was mildly effective, and oxytetracycline was the only other antibiotic that reacted against this organism. The others were entirely innocuous.

A 5% solution on a wick combined with chloramphenicol by mouth has at times proved satisfactory. When the canal is moist or the patient complains of a marked itchiness, 5% Sulfamylon in methylcellulose provides a protective coating to the skin, which is often helpful. It can also be used on a wick and the patient instructed to moisten it from time to time with the same solution.

An antibiotic which has recently proved effective in otitis externa is polymyxin B sulfate. The sterile powder is stable indefinitely at room temperature; aqueous solutions remain potent for at least six months if kept refrigerated. Under the trade name of

Aerosporin, this sterile otic solution contains 0.1% (10,000 units per 1 cc.) in acidified propylene glycol. It is markedly hygroscopic, and the very low surface tension enables it to spread quickly to all contiguous surfaces. The solution is acidified with 1% acetic acid to restore the desirable pH to the skin surface and in the case of chronic otitis media the aural mucosa.

It destroys Pseudomonas and is also bactericidal to some Gram-positive organisms, including staphylococci and streptococci. Polymyxin B also kills certain fungi.† When other infections are present, polymyxin B may be used in conjunction with other antibiotics or chemotherapeutic agents which may be indicated. For example, it may be used with bacitracin, which is effective against Gram-positive organisms. Both polymyxin B and bacitracin have low degrees of toxicity on local application, and there is little likelihood of sensitivities developing, as is often experienced when penicillin and sulfonamides are applied topically. After cleansing and drying the canal thoroughly, the drops can be instilled into the affected ear three or four times a day, as described above. If preferred, polymyxin B may be applied by saturating a gauze or cotton wick, which can be left in the canal for 24 or 48 hours and kept moist by repeated applications of the solution.

Granted that over 60% of cases of diffuse external otitis are due to Pseudomonas and a great many chronic middle-ear infections are caused by the same Gram-negative organisms, this antibiotic seems indicated.

An added advantage is the fact that resistant strains rarely develop during the clinical use of polymyxin B in any form and can be produced in the laboratory only with difficulty.[11] Development of sensitization to polymyxin B is apparently exceedingly rare.

A recent article [12] states:

> This drug not only is the most active agent available at present for the treatment of Pseudomonas infections but also appears to be quite safe for topical and parenteral administration in dosage schedules for eradication of the infection in most instances.

As mentioned, polymyxin B can be given by mouth in tablet form but, as it is not absorbed from the intestinal tract, is of no use for ear infections by this route. It can be given intramuscularly as well as by local application. (For adults the usual dosage is four to eight 50-mg. tablets of polymyxin standard per day.) A form of this antibiotic which has been found to be useful is a solution of 0.1% polymyxin B in methylcellulose. It is very stable and can be swabbed gently along the canal wall to relieve moisture and itchiness.

In the treatment of acute eczematous dermatitis involving the ear canals, careful cleansing, the application of a soothing ointment, and the avoidance of any mechanical intervention, such as scratching, give the best results. Any secondary infection should be treated with the appropriate systemic antibiotics. It has been stated that when the Streptococcus organism can be found on bacteriological examination a 5% solution of ammoniated mercury produces rapid healing.

In the chronic stage of the eczematous conditions it is important to remove the scales from the cutaneous surface of the canal and to try to reestablish normal skin physiology. The latter is a very difficult, if not at times an impossible procedure, because of the underlying metabolic and emotional factors so frequently seen.

An ointment containing polymyxin B with bacitracin (Polysporin) has been found to be useful in this scaly type of eczema. Another antibiotic which is claimed to be free of allergic tendencies is neomycin. Used as an ointment, neomycin sulfate (Myciguent), 5 mg. per gm., is helpful in relieving the dryness and itching in many of these cases.

Today the otologist is fortunate in having at his disposal water-miscible bases, such as oil-in-water emulsions with wetting agents, which seem far superior to many of the old-fashioned ointments. One that has proved satisfactory is Pragmatar. It is composed of sulfur, 3%; salicylic acid, 3%; cetyl alcohol

† References 9 and 10.

coal tar distillate, 4%. Dermatologists have used it extensively in cases of seborrhea to relieve scaliness and itching. When these conditions exist in the external auditory canal this agent is often helpful and has been recommended by the "Manual of Dermatology."[13] It is strongly acid, with a pH of about 3. A newer product which acts as a local anesthetic and is said to be free of sensitivities is 1-(betadimethylaminoethoxy)-3-*n*-butylisoquinoline hydrochloride (Quotane) (S. K. F.). Two preparations are available: Quotane Ointment, for dry fissured lesions, and Quotane Lotion, for moist, weeping raw surfaces. Both contain 0.5% Quotane. The absence of side-reactions is, of course, important. These products have been recommended specifically for otomycosis and other fungal infections of the outer canal.

In India fungus infections are very common. At the present time we have four graduates from Indian universities in the ear, nose, and throat department of the Royal Victoria Hospital, in Montreal. When I questioned them about their treatment of furunculosis and external otitis, two who had practiced our specialty were very helpful. One stated that in acute furunculosis with marked swelling of the external canal, in his experience, magnesium sulfate in glycerin on a pack was most successful. The packing gauze was saturated with this hypertonic solution and inserted into the canal and replaced each day. It was found to be very soothing, and as the canal opened up a larger gauze wick was inserted. We have been in the habit of using gauze or absorbent cotton soaked in evaporating lead lotion in these acute cases, with similar results.

Fungus infections are particularly prevalent in the state of Madras (India) and appear to be chiefly of the Aspergillus niger type. During the rainy season (June, July, August, and September) the weather is hot and humid, with temperatures ranging from 90 to 100 F day and night. Fungoid infections are endemic, especially in those who use the public baths and swimming pools, where the water is changed perhaps every two weeks.

In this type of case metacresylacetate (Cresatin) in olive oil has proved to be very beneficial. A narrow piece of gauze soaked in metacresylacetate, one part, and olive oil, three parts, inserted into the canal tends to reduce the swelling and relieve the pain. The patient is asked to report daily for the pack to be removed and the ear cleansed of debris. On syringing with boric acid or saline a whole cast of the canal comes away, which resembles a burnt cigarette butt. After three or four such treatments, the canal is widely open in most cases and the pain has been relieved.

Metacresylacetate is fungicidal and bactericidal and has a local analgesic effect. It acts on Pseudomonas and has a pH of 5.4. A mixture of 1% thymol in metacresylacetate is perhaps more effective. A wick saturated in this solution is left in place for 24 to 48 hours, depending upon the clinical response. On removal of the pack 5 or 6 drops of the same solution is instilled into the involved canal twice daily for several days.

Dibromosalicylaldehyde solution is effective against Gram-negative organisms and fungi. A wick soaked in a 2% solution is inserted into the canal and kept moist. Once the infection is controlled, insufflations of dibromosalicylaldehyde powder are often helpful. The pH is, however, 8 to 8.2, i. e., slightly on the alkaline side.

Nitrofurazone (Furacin) is said to be effective against Gram-positive cocci and diphtheroids. The pH of this solution has not been established, but the treatment is similar to the above.

Coparaffinate (Iso-Par) ointment is an effective fungicide and bactericide. It has a local anesthetic effect, stimulates healing, and is said to be nontoxic. A wick dipped in this ointment is placed in the meatus and left there for two days. This is repeated until the ear is dry. It is slightly acid, with a pH of 5.7.

Recently acetic acid has been added to many of the drops used at present for ex-

ternal and middle ear infections. Aluminum acetate with acetic acid (Burrow's solution) is an old-fashioned remedy for otitis externa, which has stood the test of time.

In two articles during the last three years Ochs ‡ reported on the use of household vinegar as a source of acetic acid in clearing up lesions in the skin of the external canal and in chronic middle-ear infections. In his last article he states:

> The use of vinegar in medicine dates back to antiquity. Beyond doubt, vinegar is the first antibiotic known to man, a bacterial product antagonistic to other organisms. Thus, the principle of antibiosis actually has been used by physicians since the earliest civilizations. Topical use of vinegar in the ear is described in an Assyrian medical text, translated by Thompson.[16] The Jewish Encyclopedia mentions several medical uses of vinegar in biblical times, including its use as a wet dressing on wounds.
>
> The Encyclopedia Britannica states that vinegar was used medically by Hippocrates in 400 B. C. The new Oxford English Dictionary quotes Holland in 1601 as follows: "Vinegar dregs are known to be verie good for to heale burns."
>
> It is often used today as a wet dressing in treating Ps. aeruginosa infections of the skin and as a vaginal douche.

Experiments have shown that acetic acid in dilutions as low as 0.33% is capable of inhibiting not only Gram-negative organisms but also many of the Gram-positive pathogens.

My interest in this form of treatment was renewed after a recent trip to Africa. After the meeting of the International Congress of Otolaryngology in Amsterdam last June, we visited Cairo and then flew down the Nile to Nairobi, which is on the equator. We had been invited by a friend, Dr. John Williamson, to visit the fabulous mine that he discovered and developed in Tanganyika. His plane met us and took us to Mwadui, 300 miles below the equator, which is about two-thirds down the length of the continent. Here in a hot part of Africa this enterprising pioneer had built a whole new town occupied by 3000 persons. Recreational facilities, such as bowling, soccer, and tennis, are provided for the natives, as well as the latest movies. The houses are well spaced on clean, wide, dirt roads, lighted by electricity. A modern hospital, which is well equipped, takes care of the health of the community. Dr. Pandit, a full-time Indian doctor, and five nursing sisters comprise the medical staff.

In conversation with Dr. Pandit the subject of external otitis, which is endemic in this area, was discussed. He was familiar with the American journals and the antibiotics used at present in treating otitis externa. Among the older well-known remedies he mentioned were acriflavine, silver nitrate, methylrosanilinechloride (gentian violet), boric and salicylic acids in alcohol.

The interesting point is that, although he had used all these drugs from time to time, he found commercial vinegar to be more effective than any of the others. He said that the native witch doctors had been using it for years in all "running sores," including discharging ears, with good results. Without any scientific knowledge they had found through long experience that vinegar cleared skin infections, lessened odorous discharges, and in full strength was quite innocuous to normal or damaged tissue. They simply poured vinegar in the affected ear six or eight times a day, and if the infection appeared to be near the entrance, they placed a wick in the canal and kept it soaked with the solution. These remarks were corroborated by a German doctor in charge of a hospital at Geita, 100 miles away from the diamond mine.

Another agent which is present in many of the ear drops currently advertised is urea. A number of articles have stressed the débridement properties of urea, the fact that it digests pus and reduces odor, and also that it is quite harmless to tissue when used in normal concentrations. The property of urea to dissolve proteins was first noted by Spiro [17] in 1900. Fifty-two years ago, in an account of the action of urea upon proteins, Ramsden [18] independently made the very interesting observation that "urea prevents putrefaction." Four years later (1906)

‡ References 14 and 15.

Wilson [19] found that 8% urea prevented the growth of B. coli. In the same year the first detailed study of urea as a bactericide was published by Péju and Rajat.[20] They found that on media containing urea there was less and less bacterial growth, until media saturated with the compound remained sterile. They also found that, among other organisms, B. pyocyaneus was easily destroyed by urea in concentrations as low as 25%. Various forms of cocci (staphylococci, streptococci, and pneumococci) were found to be more resistant.

> Thus in urea we have a substance which in the dry state is permanently stable, which is practically non-poisonous, and which, even in low concentration (3 per cent), affects the growth of bacteria, is inhibitive to growth at about 8 to 10 per cent, and is markedly bactericidal to non-sporing bacteria in the higher percentages.[21]

Some of these facts at least have been known to the African medicine men for years, because goat's urine has been a favorite remedy for generations in cases in which a foul-smelling discharge is present. Dressed in gaudy costumes, with their faces painted, the native witch doctors dance around singing incantations and then apply moist compresses of goat's urine to the infected wounds. In the case of running ears, whether from the tympanum or external canals, the urine is simply poured into the affected ear six or eight times a day. An interesting point is that the treatment is considered more effective if the urine is from a goat that is pregnant. Perhaps the hormonal factor is also helpful.

Among the well-known ear drops which contain urea are Otosmosan (a liquid containing 20.5% sulfathiazole carbamide incorporated in dehydrated glycerol), Glycerite of Hydrogen Peroxide (a solution containing hydrogen peroxide, 8-hydroxyquinoline, and glycerol), and Otomide (a solution containing carbamide, sulfanilamide, glycerin, and chlorobutanol).

A relatively new agent has shown promising results in the last few years. It appeared in the English literature under the impressive formula of ethyleneglycolmonophenylether, to which the name of Phenoxetol has been given. In the United States it is called Phenylcellosolve. It is a colorless, viscous liquid with a pleasant smell and is soluble in water, alcohol, glycerin, etc. These solutions are perfectly stable, and the pH lies between 6.4 and 6.5.

In test-tube and clinical tests Phenoxetol was found to be most effective against B. pyocyaneus and often P. vulgaris and less effective on Gram-positive organisms, such as S. aureus and streptococci. Gough, Berry, and Still [22] reported their findings in the *Lancet* as follows:

> Our results have shown that, when treated with Phenoxetol, surface wounds in which pyocyanea is apparently present alone, or there is a mixed infection with pyocyanea predominating, show changes in the flora and clinical improvement. . . . There seems little doubt that it has been the removal of pyocyanea that has led to clinical improvement.

Phenoxetol, 2.2%, has been used with success in otitis externa associated with pyocyaneus infection. Combined with acriflavine, 1 in 1000, it is more effective when Gram-positive organisms are present. When benzalkonium (Zephiran) chloride tincture, 1 in 1000, is added to Phenoxetol, 2.2%, it acts as a wetting agent. These solutions have been used during the past two years on pledgets or as drops and have given good results.

A paper such as this would not be complete without some reference to hydrocortisone. It has been stated that the dermatological management of external otitis should consist of two parts: control of the secondary infection and treatment of the underlying dermatosis. Sulzberger and Rein [23] have shown recently that hydrocortisone ointment applied locally to the ear canal relieves the inflammation and pruritus in some cases of otitis externa. It is obvious, however, that use of an ointment does not favor the dispersion of the therapeutic agent into the inner part of the ear canal; furthermore, continued application of a grease tends to fill up the canal, rather than favor drainage. This suggested to Baer and Litt [24] the use of hydrocortisone in aqueous suspension as ear drops for the

treatment of otitis externa. After encouraging results were noted from the use of a hydrocortisone suspension alone, combined treatment was tried with hydrocortisone and an antibiotic known to be effective against P. aeruginosa (neomycin or polymyxin B.).

A commercial preparation, Neo-Cortef, cortisone acetate with neomycin sulfate sterile suspension, has proved to be successful in many obstinate cases. After carefully cleansing the canal the drops are simply instilled into the external meatus two or three times a day. However, better results are obtained if a wick saturated in the solution is inserted gently into the canal for a few days and the patient instructed to keep it moist with the drops. After removing the wick the drops are used alone twice a day for perhaps a week. Usually the inflammation, exudation, and itchiness tend to subside within a few days. Occasionally patients have to use the medicament for months, but the majority can discontinue this therapy after a short period of time.

The topical application of hydrocortisone antibiotic suspension is a purely symptomatic form of treatment, so that unless the underlying cause is eliminated no permanent result can be expected. Up to the present time, as far as is known, there have been no cases of eczematous sensitization to hydrocortisone reported, and only a very few allergic reactions to neomycin.[25] In view of this, suspensions such as the above are particularly suitable for local use in otitis externa. Another solution, named Cortril (hydrocortisone acetate), can be used in the same way. Both can be supplemented by tablets (20 mg.) of the same preparation given two or three times a day by mouth.

In conclusion, it should be mentioned that many of the older remedies that have been used for years are still helpful in many cases. These, of course, are the time-honored mercury and resorcin ointment, drops, such as alcohol, acriflavine, dyes, etc., and various dusting powders.

However, in general, the tendency in recent years has been to take advantage of the increased knowledge at our disposal and to prescribe the newer agents that are at present available. Finally, in the treatment of otitis externa it cannot be stressed too strongly that unless the underlying causes, such as allergic, physical, chemical, endocrine, psychomatic, and emotional factors, are corrected, recurrences are liable to occur.

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News and Comment

ANNOUNCEMENTS

Sixth International Congress of Otolaryngology.—The Sixth International Congress of Otolaryngology will take place in Washington, D. C., from Sunday, May 5, through Friday, May 10, 1957, under the presidency of Arthur W. Proetz, M.D. The subscription for Members is $25.00 (U. S. A.), which will include all official meetings of the Congress except the banquet. Ladies and other relatives accompanying Members may be registered as Associates at a fee of $10.00.

The selected subjects for the Plenary (Combined) Sessions to be held Monday, Wednesday, and Friday mornings will be:

1. Chronic Suppuration of the Temporal Bone
2. Collagen Disorders of the Respiratory Tract
3. Papilloma of the Larynx

Outstanding internationally recognized authorities will open the discussion of each of these subjects.

Two types of communications are invited: 1. Contributions to the discussions of the selected subjects, limited to 5 minutes. 2. Original papers, limited to 15 minutes. These should be in one of the four official languages: English, French, German, Spanish.

Motion-picture films will be shown continuously except during the Plenary Sessions. There will be both scientific and technical exhibits.

An interesting program of tours, social functions, and visits to points of interest in and around Washington has been arranged for the Associate Members.

For further information please address the General Secretary, Paul H. Holinger, M.D., 700 N. Michigan Ave., Chicago 11, Ill., U. S. A.

Use of Autonomic Stabilizer in Functional Disorders of Nose, Throat, and Ears

H. MEYERSBURG, M.D., Brooklyn

The effects of the emotions on various organ systems have been covered extensively in the medical literature, but comparatively little has been written on the psychosomatic aspect of the nose, ear, and throat diseases. Wolff and co-workers [1] have observed that a life situation engendering conflict and anxiety is followed by nasal hyperfunction exaggerating the symptoms of rhinitis. Weiss and English [2] point out that emotional factors can be an underlying basis in patients who continuously "catch cold." Emotional imbalance has been suggested as a causative factor in vasomotor rhinitis [3] as well as in Ménière's disease.[4]

In addition to the effect of the emotions, many of these complaints can frequently be attributed to autonomic imbalance. Fowler [5] expresses the view that the allergic type of cold is due to parasympathetic overactivity while the infectious type may be due to overactivity of the sympathetic nervous system. Rothlin and Bircher [6] point out that not only histamine but also acetylcholine and epinephrine may produce hyperexcitability of autonomic effector organs in allergic disease. We had observed that a very high percentage of patients who did not respond adequately to the accepted nose and throat treatments also presented a higher incidence of diverse symptoms suggesting autonomic imbalance. These were related to both cholinergic and adrenergic nerve fibers and suggested that drugs blocking these stimuli might prove useful as a basis of treatment. A review of the literature revealed that a preparation * containing ergotamine tartrate, alkaloids of Belladonna (Bellafoline), and phenobarbital had been used with good effect in the treatment of symptoms associated with autonomic instability. Its use as prophylaxis in a typical syndrome of autonomic instability, recurrent headache,† was especially intriguing and encouraged us to try it in the conditions described herein. The initial results were sufficiently rewarded to warrant the full-scale study which is reported here.

METHOD AND MATERIAL

This series comprises 109 private patients, all ambulatory, most of them referred, and covers a period of two years. There were 39 men and 70 women. They ranged in age from 24 to 74, with an average of 54 years. The following types of cases were treated:

Vasomotor rhinitis	15
Pharyngeal neurosis	28
Tinnitus aurium	46
Migraine headache	4
Cardiospasm	2
Pharyngeal abrasion	6
Trifacial neuralgia	5
Psychophonasthenia	2
Gasserian ganglion involvement	1
	109

All these patients were treated in the following manner:

(*a*) Complete examination of nose, throat, ears and larynx

(*b*) Surgery when indicated. Antibiotics and vasoconstrictors were used as well as antihistaminics as required.

(*c*) Discussion with the patient concerning his chief complaints and the difficulties he was experiencing, and an attempt made to analyse his problems. Bellergal was prescribed, the dosage varying ac-

* Bellergal, Sandoz.

† References 7-9.

cording to the individual need. Average dose was one tablet before meals and one at bedtime.

RESULTS

The Table summarizes our results for the entire group.

Vasomotor Rhinitis (15 Patients).—The main symptoms in this group were sudden onset of attack accompanied by sneezing and a watery nasal discharge. There were also itching of the eyes with lacrimation, pruritus around the nasolabial folds, and a "clogged" feeling of the nose. All these symptoms responded favorably, with only one patient failing to show any response. Nine patients of this group received an antihistaminic as well. Chemical desensitization was occasionally utilized.[10]

Results of Treatment with Bellergal

	Patients, No.		
	Total	Response	Failure
Vasomotor rhinitis	15	14	1
Pharyngeal neurosis	28	16	12
Tinnitus aurium	46	28	18
Migraine headache	4	4	0
Cardiospasm	2	2	0
Pharyngeal abrasion	6	6	0
Trifacial neuralgia	5	5	0
Psychophonasthenia	2	2	0
Gasserian ganglion	1	0	1
	109	77 (72%)	32

Pharyngeal Neurosis (28 Patients).—The main symptoms in this group were "lump in the throat," referred to oftentimes as "globus hystericus" and frequently associated with rather bizarre complaints. In none were there objective confirmatory findings. These were seldom encountered in the younger age group. Two patients received injections of thiamine hydrochloride. Of the 28 patients treated, 16 were relieved. Of the 12 not relieved, there were 3 known cases of psychoneurosis.

Tinnitus Aurium (46 Patients).—The main symptoms in this group were head noise with varying degrees of intensity and a variety of sounds indicative of the type of hearing impairment. Patients with the purely conduction type usually complained of sounds like "rushing water" or "low-pitched sounds" such as are produced by a motor. In the perception type there was almost invariably a complaint of a noise like a "shrill whistle" or like "escaping steam from a radiator." This is by far the largest group and the one most important to the otolaryngologist. Of this number, 28 enjoyed various degrees of relief; 18 were not helped. Most of the 18 failures were advanced cases of auditory neuritis and fixation deafness.

Migraine Headache (4 Patients).—The chief complaints in this group were episodes of frontal, vertex, and occipital pain, associated with varying degrees of gastric discomfort and nausea, with vomiting in two patients. All had prodromal subjective warnings. All the patients in this group were relieved. Two received ergotamine with caffeine (Cafergot), and all were put on low-salt diets and received antihistaminics in addition.

Pharyngeal Abrasion (6 Patients).—The main symptoms in this group were complaint of the presence of a foreign body, with the patient insisting, even though the body actually was no longer present. It had, however, caused an abrasion which was visible in the oropharynx and on the hypopharynx. All patients in this group were relieved of the discomfort resulting from foreign bodies having been previously lodged in the pharynx.

Trifacial Neuralgia (5 Patients).—The main symptoms in this group were severe neuralgic pain on the side of the face and head, associated with lacrimination from the corresponding eye, and sneezing. These varied in degree of severity and were relieved in all patients. Of this group, treatment with quartz light therapy was directed to the nasal ganglion in two cases which were obstinate.[11] One patient with ganglion involvement received no benefit.

There were two patients who had forgotten how to speak, (psychophonasthenia) and both improved in association with speech therapy.

SUMMARY AND CONCLUSIONS

This study comprises a series of 109 patients presenting a variety of functional complaints referable to the nose, throat, and ears which had remained refractory to a number of medicinal agents. Seventy-two per cent of this group responded favorably to a regimen of treatment with a preparation of ergotamine tartrate, alkaloids of Belladonna, and phenobarbital (Bellergal) in addition to accepted otolaryngologic procedures. These results reveal the usefulness of Bellergal in the management of labile persons presenting evidence of autonomic instability.

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The Control of Epistaxis by Arterial Ligation

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The problem presented by the patient with a stubborn and persistent nosebleed always has been and always will be a constant source of trial and anxiety for the physician, the bleeder, and his family. The literature for the past 20 years is replete with splendid papers on the etiology and general conservative management of nosebleeds.* Some authors feel that haste in treatment need not be necessary, while others have recognized the mental apprehension attendant upon visible bleeding anywhere above the clavicle.† We have all observed that prolonged and persistent bleeding from the lower intestinal or vaginal tracts never excites the same degree of apprehension, even though the patient is bordering on surgical shock. The variety of methods of conservative treatment of persistent epistaxis is equaled only by the number of different etiological factors which may come into play. It is not the purpose of this paper to discuss any of these. There is, however, a small number of cases which defies all such attempts at stoppage. This number remains ever-present, despite the increase in experience which comes from seeing a large volume of cases in practice. The theme of certain writers would leave the impression that one of the various conservative measures must surely work and that if all else fails then a submucous resection must certainly do the deed.‡ Current textbooks in discussing bleeding from branches of the anterior ethmoidal artery advocate ligature of the external carotid. Should this fail, the next procedure advised is to tie the common carotid artery. Of eight standard texts § only two mention the advisability of interrupting the anterior ethmoidal artery.

In establishing the anatomical basis and surgical principles for the life-saving procedures to be described, no one has done more than Macbeth and his co-workers [14] to lead the way.

> In cases of bleeding from the anterior ethmoidal artery, ligation of the external carotid, although diminishing the total blood flow through the arterial network in the nasal mucous membrane, does not usually control the hemorrhage. While it is true that except for the rare instances in which the ophthalmic artery springs from the external carotid (Adachi, 1938), the ethmoidal arteries derive their blood supply from the internal carotid artery, ligation of this vessel will not, in the majority of cases, control hemorrhage from the ethmoidal arteries because of the anatomical efficiency of the Circle of Willis. Clearly the logical method of controlling hemorrhage from the roof of the nasal cavities is by interrupting the flow of blood through the ethmoidal arteries themselves. They can be exposed in the orbit shortly after they spring from the nasal branch of the ophthalmic artery.

Morse [15] stated that if nasal bleeding cannot be controlled within one week by conventional methods, ligation of a major artery of the neck is indicated—provided the source of the bleeding has been established. In addition to saving a life, it is financial economy and reduces the mental and physical stress on the patient and physician.

Ligation of a principle artery for the control of hemorrhage was first performed more than 150 years ago in 1803 by Fleming.‖

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* References 1 and 2.

† References 1 and 3.

‡ References 4 and 5.

§ References 6 to 13.

‖ Quoted by Bartlett and McKittrick.[16]

In establishing the source of the bleeding the use of the middle turbinate as a landmark is useful—bleeding above it is from a branch of the internal carotid system, below it is from the external carotid system. Manual compression of the common carotid artery in the neck can be helpful, for if it does not conspicuously diminish the hemorrhage, it would strongly suggest an origin from the anterior ethmoidal artery.[17]

Spar and Hallberg [18] reported 11 cases out of 106 hospitalized patients at the Mayo Clinic in which bleeding was coming from the sphenopalatine artery and which responded to ligation of the external carotid artery after all else had failed.

Christie [21] reported on 123 hospitalized cases in 10 years, 2 of which required surgical intervention: 1 on the external carotid and 1 on both external carotid and anterior ethmoidal arteries.

Perhaps the earliest recorded case of surgical interruption of the anterior ethmoidal artery for epistaxis was that of Goodyear in 1937.[22] Since then only 18 cases have been reported.¶ In 1945 Williams [25] was successful in arresting nasal hemorrhage by ligation of the anterior ethmoidal artery after an unavailing attempt was made by tying off the external carotid.

Fitz-Hugh and Risher [26] in an excellent article cited a case where hemorrhage was completely controlled with the additional ligation of the anterior ethmoidal artery. The posterior ethmoidal artery is small and rarely causes trouble. Ligation is indicated when nasal hemorrhage persists and recurs with severity and the level of the hemoglobin and the number of red blood cells drop steadily despite repeated nasal packing and transfusion of blood. It is not safe to wait until the patient has lost so much blood that a state of shock supervenes.

Sackadorf [27] and Harkins [28] have also reported success in the arrest of bleeding with ligature of the appropriate principal artery.

¶ References 23 and 24.

REPORT OF A CASE

J. J. B., a 47-year-old white electrician, was accidentally struck on the left side of the nose by a metallic pipe on Nov. 27, 1951. About 18 hours later (on Nov. 28, 1951) severe bleeding occurred from the left nostril while he was at work. He was rushed to a first-aid station, where an anterior packing was inserted by the physician in attendance, and he was referred to the office for consultation. The patient gave a history of heavy drinking and smoked 30 cigarettes daily. He had a son who suffered from coarctation of the aorta. The patient was advised to enter the hospital for observation, and on his way over (150 yd.), further profuse bleeding occurred.

Examination disclosed a well-developed man, conscious and rational. There was active arterial bleeding from the left middle meatus. The vessel was spurting and difficult to control. Shortly following admission the anterior packing was removed and reinserted together with oxidized cellulose (Oxycel) gauze in both nostrils. On Nov. 29, 1951, at 2 a. m. a posterior packing was inserted and the nose repacked anteriorly. By 8 a. m. there were alternate periods of oozing and stoppage. The patient became increasingly restless and uncontrollable, frightened, and panicky, despite 2 doses of morphine sulfate, ¼ grain (15 mg.), and 3 of various barbiturates spaced apart.

Laboratory investigation shortly on admission showed the following:

Hemoglobin level, 13 gm./100 cc.
Red blood cells, 4,280,000
White blood cells, 16,500
Polymorphonuclear leucocytes, 56%
Lymphocytes, 40%
Mononuclear cells, 3%
Eosinophiles, 1%
Bleeding time, 50 sec.
Coagulation time, 5 min., 40 sec.
Platelets, 190,000 per cu. mm.
Prothrombin time, 15.1 sec. (approximately 60% of normal concentration)
Blood pressure, 130/90

Eighteen hours after admission the hemoglobin level had fallen to 11 gm./100 cc., the red cells to 4,000,000. Urinalysis was normal. The epistaxis at this point was thus far uncontrollable, and as a definitive move it was decided to ligature the external carotid artery to effect control of the bleeding point.

With the patient under intravenous thiopental (Pentothal) sodium induction, followed by endotracheal nitrous oxide, oxygen, and ether anesthesia, an incision was made 3 in. long, extending between the upper border of the thyroid cartilage and the angle of the mandible and parallel with the anterior border of the sternomastoid muscle. The carotid sheath was exposed, the external carotid identified, and the sheath removed between the superior

thyroid and lingual branches. A double ligature of No. 0 black silk was applied and securely tied. The nose was then cleaned of all blood clots and repacked with ½-in. gauze packing on both sides. There was no further bleeding at the close of the operation.

Because of the desire to keep the patient as quiet as possible in the immediate postoperative period, phenobarbital sodium was given intramuscularly. When the patient became increasingly restless, paraldehyde, amobarbital (Amytal) sodium, and scopolamine (Hyoscine) were in turn given, with little success in controlling what became a manic state. This was most distressing to his medical and nursing attendants because of the possibility of further bleeding. For five days the patient was restrained to his bed and fed parenterally. Off and on there was a slight ooze from the left nostril, which was easily controlled by a small amount of accurately placed packing and manual pressure exerted on the outside of the tip of the nose. He lapsed in and out of a comatose state and on occasion talked incoherently. On the fifth postoperative day he appeared greatly improved and made steady progress from then onward. Electrocardiographic tracings and radiological examination of the skull showed no abnormalities. Lumbar puncture revealed no abnormal pressure or spinal block. Analysis of the cerebrospinal fluid showed normal findings. He was discharged home on the 11th day free of symptoms and with retrograde amnesia for the immediate postoperative period.

For 11 months the patient remained well and submitted to periodic check-ups. In November, 1952, while visiting at another city, he suffered a nosebleed on the left side, which was controlled by anterior packing.

On Dec. 4, 1952, bleeding was noticed again—without any history of antecedent injury—this time from Little's area on the left side. On Dec. 5 he bled several times from this site and the area was cauterized under local anesthesia with a chromic-acid bead. On Dec. 7 profuse bleeding was encountered from the lateral wall of the nose on the left side. It could be identified only as coming from the area above the middle turbinate. Inspection of the oropharynx showed a steady dripping of blood behind the left posterior pillar of the fauces. His blood pressure was 130/100. Laboratory studies at this time were within normal limits.

Inasmuch as the bleeding was coming from the area supplied by the internal carotid artery via the ophthalmic and ethmoidal arteries, it was decided to ligate the anterior ethmoidal as it is found on the medial aspect of the orbit.

With intravenous thiopental sodium anesthesia supplemented by endotracheal oxygen, a curved incision was made starting at the medial end of the eyebrow and extending downward on the skin overlying the nasal bone. The incision was deepened to the bone. The fibers of the superior oblique muscle were separated and the orbital structures displaced laterally. Dissection was carried along the medial wall of the orbit until the anterior ethmoidal foramen was seen with the anterior ethmoidal vessels emerging from it. A 000 black silk ligature was placed around the vessels with a fine aneurysm needle and two separate ligatures tied to seal the vessels. The posterior ethmoidal vessels, being very much smaller, were not interrupted. Anterior and posterior packings were then inserted in both nostrils.

In the immediate postoperative period barbiturates were given for sedation, and it was soon apparent that they were not having the desired effect of affording the patient adequate rest. He became restless and uncontrollable in the same fashion as the previous year. It was suspected at this time that he was manifesting an idiosyncrasy to barbiturates. A patch test was done and a pronounced positive reaction obtained. The remainder of this operative period was marked by transient diplopia, and he was discharged on the 11th day following surgery. For the past two years he has been free of symptoms.

COMMENT

In connection with the above case it is interesting to note that on the first occasion the arterial system of the external carotid artery was involved and subsequent ligature of that artery succeeded in arresting the hemorrhage. The relationship to injury was doubtful in this instance. One year later, without warning, a further epistaxis took place on the same side but involving a different arterial system—that of the internal carotid artery. This responded to ligature of the anterior ethmoidal artery. I am inclined to agree with Macbeth, who stated that in cases where carotid ligation fails it is because the wrong arterial system has been interrupted—and in such cases ethmoidal ligation succeeds. Action for its own sake must be deplored, and only those patients failing to respond to all other methods should be referred for ligation.

SUMMARY

Certain essayists have devoted much space in a review of the arterial supply of the nose in an endeavor to prove that with their favored plan of conservative therapy arterial ligation need not be necessary. It is unques-

tionable that these methods are the first choice of the physician. It is my experience that when these attempts have failed it is not a difficult matter to perform ligation of a major vessel and that, once done, it is a grateful discovery for both physician and patient to see an end to the nosebleed. A case is reported where bleeding occurred from different major arterial systems on separate occasions a year apart. Surgical interruption of the appropriate vessel was successful in arresting the hemorrhage. The physician who treats nosebleeds must keep in mind the basic anatomical principles involved when ordinary measures fail.

Medical Arts Building.

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Dissection, Snare, and Suture Tonsillectomy

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In January, 1954, I published an article entitled "Bloodless Tonsillectomy: A New Operative Procedure."[1] The technique of this new operation may be divided into four stages. First, the extrusion of the tonsil and the conversion of its wide attachment into a broad, thin pedicle by the use of a solid blade tonsillotome after the Sluder method; second, the passing of ligatures through the pedicle for later tying; third, the amputation of the tonsil and removal of the guillotine; fourth, tying of the previously inserted ligatures. There is no bleeding in the first stage except a little oozing, such as the use of a large instrument on a delicate mucous membrane is apt to cause. The only bleeding in the second stage is what is apt to come from needle punctures. There is no bleeding in the third stage at first after the guillotine is removed because the tissues have been strongly compressed by the dull blade of the instrument. If the ligatures are tied quickly, before the tissues relax after the compression, there is no bleeding at all. Naturally, in the fourth stage, all bleeding is stopped when the ligatures are tied.

The important factors in the maintenance of the hemostasis are (1) the compression of the tonsillar pedicle by the dull blade of the tonsillotome and (2) the passing of the ligatures through the pedicle before the tonsil is amputated.

The ligatures can be passed through the pedicle by using the conventional curved needle and needle holder. This is a slow and rather difficult procedure. For a quick and easy technique, I devised a multiple needle holder with which a number of needles, one to four, can be passed simultaneously. As can be seen in Figure 1, the needle holder consists of a head, *D*, shaft, *S*, and handle, *H*. The head contains sockets for four needles. These are the usual sewing-machine needles of large size, with the eye in the point. They are removable, and each one

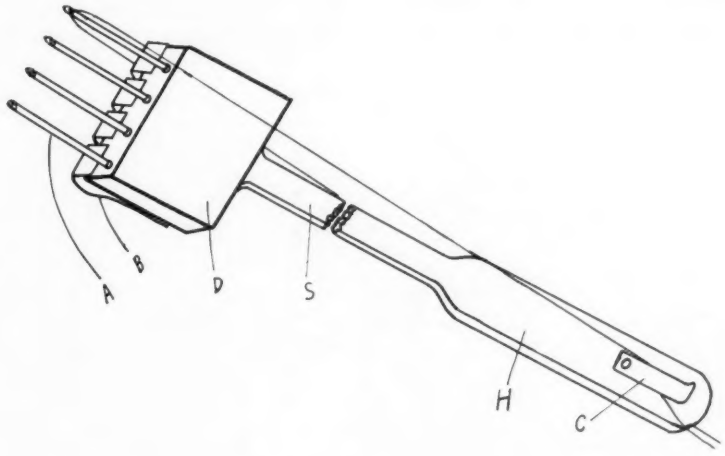

Fig. 1.—Multineedle holder. *D*, head; *S*, shaft; *H*, handle, *A*, needle with eye in point; *B*, spring for holding needle in socket; *C*, spring clip for holding ends of ligatures.

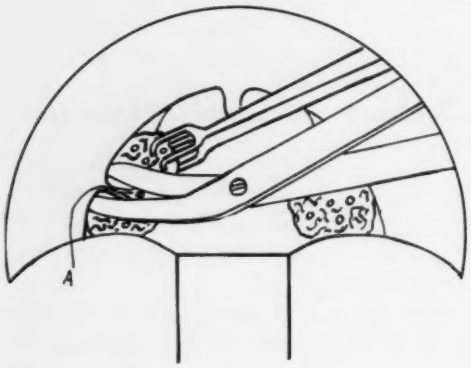

Fig. 2.—Scissors in position to cut anterior tonsillar ligament, *A*.

is held in place by an individual spring, *B*. The ligatures are threaded in the eyes of the needles before use, and the loose ends are held in place by the spring clip, *C*. In a large tonsil, four needles can be used; in smaller tonsils, three, two, or even one needle may be used.

After this paper was published, I was asked whether a similar suturing method could not be used when the tonsil is removed by the dissection and snare technique. Actually, I had developed such an operation before the extrusion and suture method, but the latter was so much more completely bloodless that I concentrated on that. However, there are a few cases where it is difficult to extrude the tonsil with a guillotine, and in these cases it is well to have an alternative method. For that reason, I am writing this paper.

The removal of a tonsil by the dissection, snare, and suture technique may be divided into five steps: first, the dissection; second, the application of the snare; third, the passing of the ligatures through the tonsil bed and stump; fourth, the amputation of the tonsil by the snare; fifth, the tying of the ligatures.

The first step, the dissection, is begun by cutting the anterior tonsillar ligament. The tonsil is grasped by a forceps and pulled backward and inward to put the ligament on the stretch. It is a short band of mucous membrane that extends from about the middle of the free border of the anterior pillar to the tonsil. This is diagrammed in Figure 2. The blades of a scissors, curved on the flat, are inserted between the anterior pillar and the tonsil, and the ligament is snipped between them. The ligament often contains some tough fibrous tissue and, if not cut, can shunt the dissecting instrument into the anterior pillar. This can result in the loss or mutilation of most or all of the pillar and a goodly portion of the soft palate. When the ligament is cut, a good portion of the front of the tonsil seems to pop out and the lines of cleavage between the tonsil and its bed become more marked, thus making dissection easier. The tonsil is dissected from its bed till about three-fourths of its upper part is free, or till it becomes clear that the glandular portion of

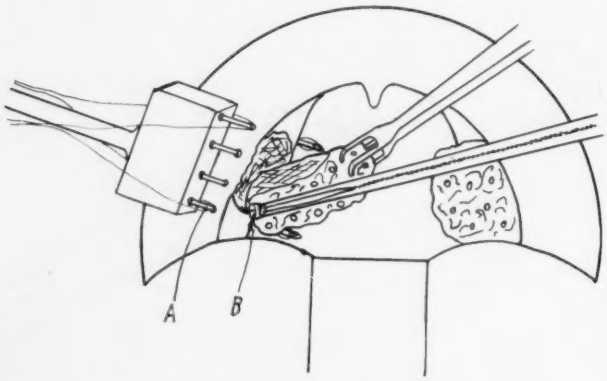

Fig. 3.—Wire loop, *B*, of snare tightened around pedicle of tonsil, and needle, *A*, passed through anterior pillar, under bed of tonsil, and through posterior pillar, with point of needle and ligature showing behind posterior pillar.

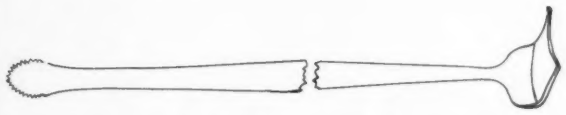

Fig. 4.—Combination tonsil dissector and palate retractor.

the tonsil is giving way to the fibrous tissue that pervades the tonsil at its lingual attachment. For the purposes of dissection, I prefer to use a combination dissector and palate retractor that I have devised, shown in Figure 4. The dissecting blade of this is serrated so that the connective tissue is cut more readily, while at the same time it is more lacerated and thus bleeds less than if cut by a straight-edged instrument.

The second step of the operation is the application of the snare. The loop of the snare is passed over the free portion of the tonsil down to the attached portion and slowly tightened till the stump is held tightly, but not cut. The snare is held in this position by screwing down the power nut.

The third step of the operation is the passing of the ligatures. The snare is used to pull the tonsil inward and forward, and the needles in the multineedle holder are inserted into the anterior pillar, about ⅛ to ¼ in. from the free border, through the pillar, under the bed of the tonsil, and through the posterior pillar. This is shown diagrammatically in Figure 3. The ligatures are picked up with a hook at the eyes of the needles, back of the posterior pillar, and one end is pulled through and held. The needles are then withdrawn, thus freeing the other ends of the ligatures, which are then matched up with the ends drawn out first.

The fourth step is the amputation of the tonsil, which is done by tightening the power nut till the wire is pulled through.

The fifth step is the tying of the ligatures.

As can be readily seen, there is no control of the bleeding from the cutting of the anterior ligament to the completion of dissection. All bleeding, however, is completely controlled when the ligatures are tied. For that reason, the extrusion and suture operation that I described previously is the operation of choice. The snare and suture operation herein described can be held in reserve for cases not suitable for the former operation.

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Audiology Section

JOSEPH SATALOFF, ASSOCIATE EDITOR

FOREWORD

The increasing interest in the phenomenon of hearing during the past few decades has produced extensive literature on the numerous problems related to hearing and the ear. These problems have attracted investigators from such diverse scientific disciplines as otology, anatomy, psychology, physiology, physics, electronics, speech and hearing therapy, insurance, law, and many others.

Newly developed media for communication are placing new values and a greater importance upon the sense of hearing in modern society. The nature and extent of these values are now in the process of evolution. They will undoubtedly be determined by the social sciences and arts as well as economics, but it is safe to say that hearing is being considered as a more vital sense than ever before. Defects in hearing are producing handicaps of dynamic significance.

At present common problems in hearing are being investigated through various approaches and reported in numerous journals and publications usually representing the specific interest of the investigator and his method of approach. This has made it quite difficult, in many instances, to keep abreast of the scattered literature and has impeded the integration and correlation of the information accumulating in the various journals.

The A. M. A. ARCHIVES OF OTOLARYNGOLOGY has recognized the need for a publication medium intimately related to otology, which would accept for publication worth-while reports from any of the various and scientific disciplines' investigation problems in hearing. To fill this need and maintain the intimate relations between clinical otology and basic investigation in hearing, the ARCHIVES will devote a section of its journal specifically for articles in audiology, which will be considered in its broadest sense to include all aspects of the science of hearing.

GEORGE M. COATES, M.D.
Chief Editor

Evaluation of Operating Conditions on a Békésy-Type Audiometer

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INTRODUCTION

With the development of the new audiometer reported by Békésy [1] in 1947, the need for research applied to the evaluation of this testing device has become increasingly apparent. Reger [3] points out that "several testing features of the 'instrument-patient' combination need early investigation" and offers a number of specific research suggestions. The present study was undertaken to provide some of the evaluative data required on the Békésy audiometer before the classic laboratory method of adjustment can be considered with respect to its general applicability in the hearing clinic. Specifically, the purpose of this study was to determine the effects of testing time and signal attenuation rate on three criterion measures: (1) threshold value at 1000 cycles per second (cps), (2) variability of response above and below mean threshold value, and (3) threshold reliability of test-retest audiograms.

APPARATUS

The apparatus of the study consisted of a Reger model of the Békésy audiometer. Except for a Brüel and Kjaer beat frequency oscillator, Type 1011, which was substituted for the General Radio beat frequency oscillator, Type 1304-A, the unit was essentially identical with that described in detail by Reger.[3] The oscillator output was presented monaurally to the subject through the right unit of a set of Permoflux PDR-8 earphones with MX 41/AR cushions. The frequency range covered in threshold testing was five octaves between 250 and 8000 cps. Since the audiogram recording board moved at a speed of 28 mm/octave at any one of three testing times (1, 2, 4 min/octave), total testing times available were 5, 10, and 20 minutes. The rates of signal attenuation were 0.5, 1, and 2 db/sec.

Inasmuch as the study was specifically designed to evaluate the effects of operating conditions on selected criteria, it was considered more expedient to run the recording board on the "curved" drive rather than the "straight" drive provided on the control unit. (A "normal" ear under this condition will produce a mean threshold curve which closely approximates the zero db line on the audiogram blank.) Earphone sound-pressure output measurements were made using a National Bureau of Standards Coupler 9-A and audiometric zero ("normal" threshold) was adjusted on the basis of the data of Sivian and White.[4]

PROCEDURE

The experimental plan of the study used a conventional two-factor analysis of variance design.[2] With three testing times (5, 10, 20 min.) and three attenuation rates (0.5, 1, 2 db/sec.), there were nine cells in the schematic double classification table. Each of the nine experimental conditions was assigned at random to 10 volunteer male and female subjects, between the ages of 17 and 25 years, obtained from an introductory course in psychology. No subject served for more than a single one-hour session. All threshold measurements were made in a soundproof room and only right ears were tested.

The instructions to the subjects were as follows:

"I am now going to run a test to find out how 'soft' a tone you can hear in your right ear. The tone you will hear will start out very 'low'; that is, it will sound something like a 'low' note on the piano. The tone will then get gradually higher and higher in pitch. Your task is to adjust the loudness of this tone so that it is always just barely audible.

This research was supported by the United States Air Force under Contract No. AF 33(038)-786, monitored by the Aero-Medical Laboratory, Wright-Patterson Air Force Base. The opinions or conclusions contained in this report are those of the author. They are not to be construed as reflecting the views or endorsement of the Department of the Air Force. Acknowledgment is made to Mr. Fred L. Royer, Mr. Raymond D. Fowler, and Mr. Samuel B. Schnitzer for assistance in data collection and analysis.

TABLE 1.—*Mean Threshold Values in Decibels at 1000 cps*

Testing Time (Min.)	Attenuation Rate (Db/Sec.) 0.5	1	2	Mean
5	6.25	6.55	8.20	7.00
10	6.30	8.90	8.95	8.05
20	5.30	6.65	10.95	7.63
Mean	5.95	7.37	9.36	7.56

Entry: Mean threshold value in each cell based on test-retest audiograms for 10 different subjects at 1000 cps (N-90).

If you want the tone to get 'softer' or 'fade away' just press this switch and hold it down. This will cause the tone to get so 'soft' that you will no longer be able to hear it. So, in order to get the tone louder again, release the switch. The tone will then gradually 'build up.' You must listen very carefully, pressing and releasing the switch in such a way that the tone is always just barely audible. Remember, to make the tone get 'softer,' press the switch; to make the tone get louder, release the switch. This sign (point to sign) will remind you of these directions. Are there any questions? (Pause.) After I have placed the headphones over your ears, do not touch them in any way. If you should need to talk to me for any reason, just speak up and I will hear you over this microphone."

In obtaining the Békésy audiograms under each of the nine operating conditions, the stimulus tone was always introduced at 250 cps, hearing loss setting 20 db., and terminated at 8000 cps. Following the completion of an audiogram, each subject was given a five-minute rest period with the headphones remaining in place; at the end of this time, a retest audiogram was obtained in the same manner as the first. The subject was instructed:

"I will now retest your hearing on the same ear. Follow the same instructions as before. Press the switch to make the tone 'softer', release the switch to make the tone louder. The test will now begin."

RESULTS AND COMMENT

In the treatment of data, the threshold curve for each subject was taken as the curve connecting the midpoints between the peaks and valleys of the ink-recorded audiogram. Reger [3] indicates that this mean value is a "usefully accurate threshold value."

The data of the threshold curves were then analyzed with respect to three criteria: (1) mean threshold values at 1000 cps, (2) threshold variability scores, and (3) test-retest reliability coefficients.

1. Analysis of Mean Threshold Data at 1000 Cps.—Table 1 presents a summary of the mean threshold values in db. at 1000 cps for each of the nine conditions of the study. In obtaining these values, the test and retest audiogram readings at 1000 cps were first averaged for each subject; the means of these values were then obtained for the 10 different subjects represented in each cell of Table 1. Notice that the over-all threshold means apparently tend to increase with increasing attenuation rate but that no systematic trend is found with increasing testing time. Further, when a 3.1 db. adjustment is made for the difference between the calibrated sound pressure level and the Sivian and White [4] value, the mean threshold at 1000 cps for the 90 subjects of the study (7.56 db.) becomes 4.46 db. and represents a mean hearing loss of less than 5 db. re the "normal" threshold of Sivian and White.[4]

To determine whether there were any statistically significant effects of testing time and attenuation rate on 1000 cps threshold values, an analysis of variance was performed on the raw data from which Table 1 was prepared. The results of the analysis are shown in Table 2.

Since none of the three F-ratios listed in Table 2 is statistically significant, the results of the analysis indicate that within the limits of this experiment neither testing time nor attenuation rate is a real factor in the determination of threshold values at 1000 cps. Also, interaction effects of testing time and attenuation rate are nonsignificant. It appears, therefore, that any combination of testing time and attenuation rate is satisfactory for use with the Békésy audiometer, when the 1000 cps threshold value is used as the criterion measure of performance.

TABLE 2.—*Summary of Analysis of Variance for 1000 cps Threhold Values*

Source of Variance	Sum of Squares	Degrees of Freedom (df.)	Mean Square	F-Ratio
Testing time (R)	16.77	2	8.38	0.14
Attenuation rate (C)	176.80	2	88.40	1.51
Interaction ($R \times C$)	65.19	4	16.30	0.28
Within cells	4745.65	81	58.59	....
Total	5004.41	89	....	....

TABLE 3.—*Mean Variability Scores in Decibels on Test (First) Audiograms*

Testing Time (Min.)	Attenuation Rate (Db/Sec.)			
	0.5	1	2	Mean
5	6.46	7.24	8.77	7.49
10	6.08	6.15	7.21	6.48
20	6.31	6.69	10.53	7.84
Mean	6.28	6.69	8.84	7.27

Entry: Mean variability score in each cell based on area measurements of test (first) audiograms for 10 different subjects (N-90).

2. Analysis of Threshold Variability Scores.—A second analysis was performed, using threshold variability scores as criterion measures. To obtain individual variability scores, a planimeter was first used to determine the total area enclosed within the envelope of the first (test) audiogram, i. e., the area enclosed between the two lines, one connecting all peaks and the other all valleys. This area measurement was then converted into a decibel reading on the basis of the rectilinear area enclosed by a 1 db. step between the frequency limits of 250 and 8000 cps; e. g., an area of 3 sq. in. (58 sq. cm.) corresponds to a variability score of 10 db. The greater the area for a given audiogram, the larger the peaks and valleys and, hence, the greater the variability (range of excursions) above and below mean threshold value.

Table 3 presents a summary of the variability data for the test audiograms. Each cell contains the mean variability score in decibels for the 10 different subjects under each experimental condition. Notice that the over-all variability means apparently tend to increase with increase in testing time. Further, the validity of the technique used in arriving at the variability scores is supported by the close agreement of the data of Table 3 and the "normal" 6 to 8 db. range reported by Reger.[3]

To test for the statistical significance of the effects of attenuation rate and testing time on variability scores, an analysis of variance was performed on the raw data from which Table 3 was prepared. The results of the analysis are shown in Table 4.

The results of the analysis presented in Table 4 show that the F-ratio for attenuation rate, with 2 and 81 df, is significant at the 5% level, but the F-ratio for testing time is nonsignificant. The F-ratio for interaction is also nonsignificant. Thus, attenuation rate appears to be the only factor which affects the range of excursions (variability) above and below the mean threshold curve on the Békésy audiogram.

TABLE 4.—*Summary of Analysis of Variance for Threshold Variability Scores*

Source of Variance	Sum of Squares	Degrees of Freedom (df.)	Mean Square	F-Ratio
Testing time (R)	30.03	2	15.02	1.18
Attenuation rate (C)	112.82	2	56.41	4.43 *
Interaction ($R \times C$)	31.81	4	7.95	0.63
Within cells	1029.72	81	12.71	....
Total	1204.38	89	.....	....

* $p < 0.05$.

TABLE 5.—*Results of t-Tests of Significance of Difference in Attenuation Rate Means*

Rate Conditions Compared	Obtained t-Value	Level of Significance
0.5 and 1 db/sec	0.44	Nonsignificant
0.5 and 2 db/sec	2.78	0.01
1 and 2 db/sec	2.34	0.02

Since the between columns (rate) variance was statistically significant, conventional t-tests were run to determine the levels of signicance of differences between column means. The computed t-values and corresponding levels of significance are presented in Table 5. (In computing the t-values, the within cells variance, with its corresponding df, was used as the error term.)

The data of Table 5 show that the difference in means of the variability scores under the 0.5 and 1 db/sec. conditions is not statistically significant; but the difference between each of these means and the mean of the 2 db/sec. condition is significant beyond the 2% level. Thus, the greater the attenuation rate, the greater the range of excursions on the recorded audiograms (Table 3). It appears, therefore, on the basis of the data

presented in Tables 3, 4, and 5, that a combination of 0.5 or 1 db/sec. attenuation rate and any one of three testing times (5, 10, 20 min.) is satisfactory for use with the Békésy audiometer when minimal variability about the mean threshold curve is used as the criterion measure.

3. Analysis of Test-Retest Reliability Coefficients.—A final analysis was performed on the Pearson product-moment reliability coefficients obtained on the individual test-retest audiograms. The coefficient for a given set of audiograms was computed on the basis of the mean threshold values at 10 arbitrarily selected frequencies: 350, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, and 8000 cps.

Table 6 presents a summary of the reliability coefficients obtained under each of

TABLE 6.—*Test-Retest Reliability Coefficients of Békésy Audiograms*

Testing Time (Min.)	Attenuation Rate (Db/Sec.)			
	0.5	1	2	Mean
5	0.94	0.68	0.56	0.73
10	0.86	0.56	0.74	0.72
20	0.68	0.51	0.60	0.60
Mean	0.84	0.58	0.63	0.68

Entry: Median value of correlation coefficients in each cell based on test-retest audiograms for 10 different subjects (N-90).

the nine conditions of the study. Since the sampling distribution of r's is markedly skewed, even for large samples, when the true correlation approaches $\pm$ 1.00,[2] median values were computed for the 10 correlation coefficients represented in each cell of Table 6. With increased testing time, the mean (of the medians) apparently tends to decrease; but, with increased attenuation rate, there is no consistent trend in means.

To test for effects of attenuation rate and testing time on the reliability of threshold measurements, all original r values were transformed to z values [2] and an analysis of variance was performed on the transformed scores. A summary of the results of this analysis is presented in Table 7.

The results of the analysis presented in Table 7 show that the F-ratio for testing

TABLE 7.—*Summary of Analysis of Variance for z-Transformed Reliability Coefficients*

Source of Variance	Sum of Squares	Degrees of Freedom (df.)	Mean Square	F-Ratio
Testing time (R)	0.81	2	0.41	0.76
Attenuation rate (C)	7.39	2	3.70	6.85 *
Interaction ($R \times C$)	4.01	4	1.00	0.09
Within cells	44.07	81	0.54	....
Total	56.28	89	0.63	....

* $p < 0.01$.

time, with 2 and 81 df, is nonsignificant; the F-ratio for attenuation rate, with 2 and 81 df, is significant beyond the 1% level. Thus, only the variable of attenuation rate produces a real effect on the (transformed) reliability coefficients obtained in this study. The interaction effect of testing time and attenuation rate is nonsignificant.

To determine the specific conditions contributing to the significance of the F-ratio for main effects, conventional t-tests were performed to evaluate the significance of the differences in means of transformed coefficients between pairs of attenuation rates. The results of this analysis are presented in Table 8. (In computing the t-values, the within cells variance estimate, with its corresponding df, was used as the error term.)

The data of Table 8 show that the mean of the transformed scores for the 0.5 db/sec. rate condition differs significantly from the means of both the 1 and 2 db/sec. rate conditions; however, there is no difference between the obtained means of the 1 and 2 db/sec. rate conditions. It appears, therefore, that the highest test-retest reliability of threshold measurement on the Békésy audiometer is obtained when an attenuation rate of 0.5 db/sec. is used, regardless of total testing time.

TABLE 8.—*Results of t-Tests of Significance of Differences in Attenuation Rate Means*

Rate Conditions Compared	Obtained t-Value	Level of Significance
0.5 and 1 db/sec	3.63	0.001
0.5 and 2 db/sec	2.42	0.02
1 and 2 db/sec	1.21	Nonsignificant

SUMMARY AND CONCLUSIONS

A Reger model of the Békésy audiometer was used to obtain test-retest right ear audiograms on a group of 90 volunteer male and female subjects between the ages of 17 and 25 years. A two-factor analysis of variance design was used with three testing times (5, 10, 20 min.) and three rates of signal attenuation (0.5, 1, 2 db/sec.). Each of the nine operating conditions was assigned at random to each of 10 subjects. No subject served for more than a single one-hour session. All threshold measurements were made in a soundproof room and all retest audiograms were obtained after a five-minute rest period.

In the treatment of data, analysis of variance techniques were used to evaluate the effects of testing time and attenuation rate on three criterion measures. The results of the study showed that (1) testing time and attenuation rate have no effect on mean threshold value at 1000 cps; (2) attenuation rate has a significant effect on threshold variability, and (3) attenuation rate has a significant effect on test-retest reliability. It is concluded that, with respect to the three criteria considered simultaneously, optimal performance on the Békésy audiometer is obtained by using an attenuation rate of 0.5 db/sec. combined with a total testing time of 5, 10, or 20 minutes.

Pennsylvania State University.

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Case Reports

MISDIAGNOSIS OF ORAL LYMPHOSARCOMATOSIS

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and
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A CASE of lymphosarcomatosis appeared to be of interest for the following reasons: 1. The only initial symptom of the disease occurred first in the gingiva and spread subsequently in the adjacent mucosa of the hard palate. After approximately 10 months, systemic manifestations appeared. 2. While the disease was localized to the oral cavity, three biopsy specimens taken at intervals were examined microscopically. The first two were diagnosed as nonspecific chronic inflammation. Since the majority of gingival lesions are of a nonspecific chronic inflammatory nature, it was not surprising that such a diagnosis was made. The real nature of the changes was recognized only after the third biopsy. In view of this information reexamination of the first two biopsy specimens confirmed the diagnosis of lymphosarcoma.

REPORT OF A CASE

Clinical History (August, 1953)

Present Complaint.—A 35-year-old white housewife (P. R.) saw her dentist in April of 1953, complaining of swollen gums around the upper left bicuspids.

Onset and Course.—The patient first noticed the gingival enlargement about six months prior to consulting her dentist. After examining the involved gingiva, the patient's dentist referred her to an oral surgeon, who took a biopsy specimen of the raised gingiva on the palatal aspect. The biopsy report was "chronic inflammation of the gingival tissue" (Fig. 1). The oral surgeon referred the patient to a physician for a medical and laboratory work-up.

From the Department of Surgery, Woodlawn Hospital, and the Department of Oral and Maxillofacial Surgery (Dr. Sarnat), and the Division of Oral Pathology (Dr. Weinmann), University of Illinois, College of Dentistry.

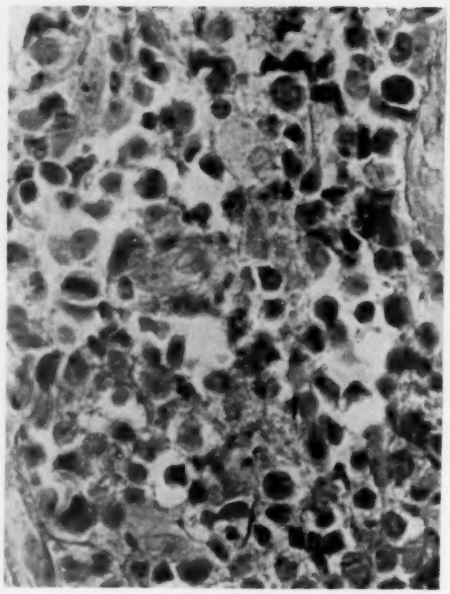


Fig. 1.—Photomicrograph of the first biopsy specimen (April, 1953), of the palatal area, showing the great variation in the form and size of cells and their nuclei. Note mitotic figures. This was diagnosed initially as chronic inflammation. Comparison of this biopsy specimen with the last one (Fig. 4), which was diagnosed as lymphosarcoma, shows the similarity of the two. Reduced 2/5 from mag. × 900.

The complete medical history and examination as well as the routine laboratory tests were negative. The physician, in turn, referred the patient to another oral surgeon in May, 1953. This oral surgeon, in view of the biopsy report and because of the presence of dental calculus, referred the patient to a periodontologist. In the meantime the swelling of the gingiva was slowly increasing in size, and in June the molar as well as the bicuspid areas were involved. The patient then saw a dermatologist, who performed two punch biopsies of the enlarged gingiva. Although a more serious condition than a banal chronic inflammatory process was suspected, no definite diagnosis was obtained (Fig. 2). Smears for fungi were made, and the results were negative. The gingival enlargement continued to spread, and the patient was given potassium iodide, but no favorable response was noted. At this time the dermatologist noticed a small left submental node and requested that her original

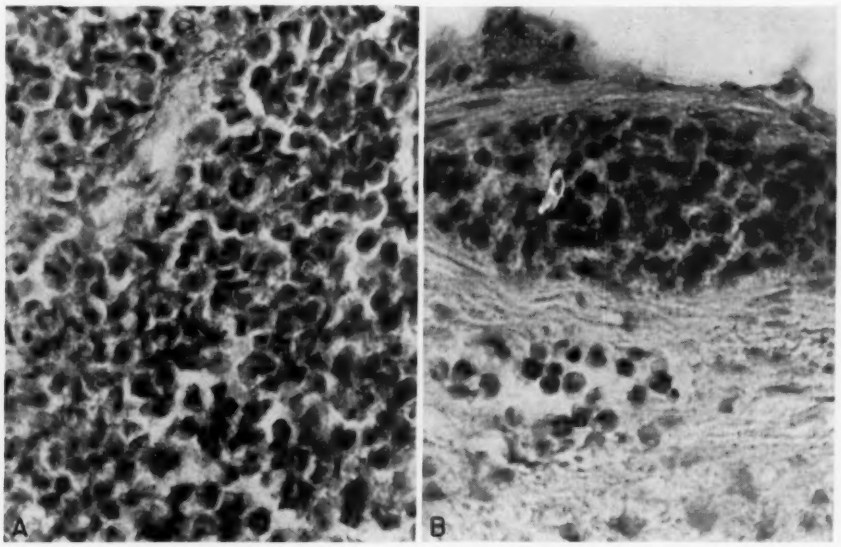


Fig. 2.—Photomicrographs of the second biopsy specimen (June, 1953), of the gingival area, of the same patient. No specific diagnosis was rendered. Reduced 2/5 from mag. × 900. *A*, Note the syncytial type of growth of the undifferentiated lymphoid cells in the corium of the gingiva. *B*, Note the accumulation of immature lymphoid cells between the squamous cells of the gingival epithelium. This could be misdiagnosed as an intraepithelial abscess.

physician take a biopsy specimen. Before anything could be done the patient left for a vacation. About the middle of August she was again examined and hospitalized for a complete work-up.

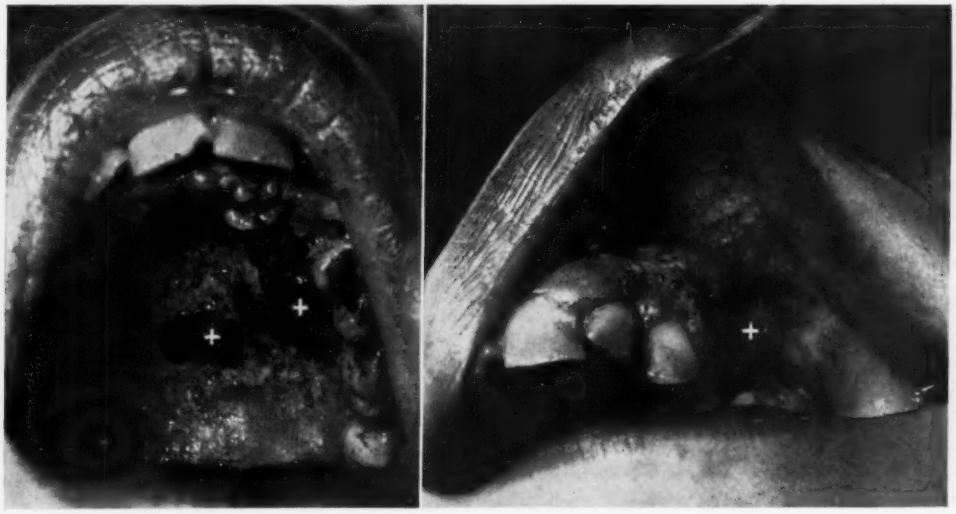
Personal History.—The patient stated that she smoked about two packages of cigarettes a day.

Family History.—Negative.

Examination and Diagnosis

Oral Examination.—In August, 1953, there was revealed a raised, irregular, pebbly area involving the buccal and palatal gingiva and extending medially to the midline of the palate and laterally to the mucosa of the cheek (Fig. 3). The lesion had spread anteriorly to the area of the incisors and

Fig. 3.—Intraoral photographs of patient, P. R., with manifestations of lymphosarcomatosis. Note the irregularity of the mucosal and gingival surfaces; +, areas from which biopsy specimens were taken.



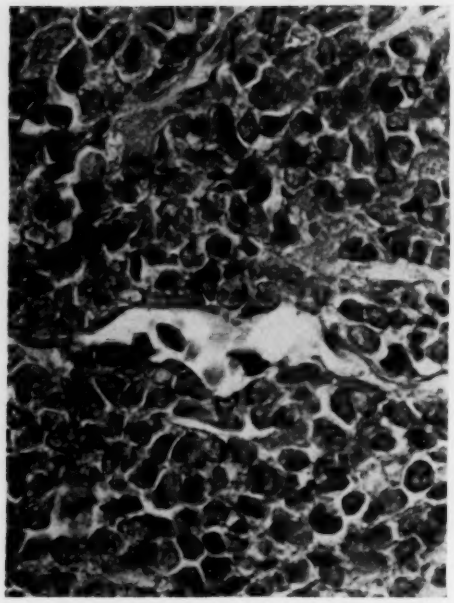


Fig. 4.—Photomicrograph of the third biopsy specimen (Aug., 1953), of the oral mucosa, diagnosed as lymphosarcoma. Note the syncytial arrangement of undifferentiated lymphoid cells in the corium of the gingiva and the mitotic figures. Note the similarities of Figures 1, 2, and 4. Reduced ⅔ from mag. × 900.

posteriorly to the retromolar gingiva and the posterior border of the hard palate. The tissue appeared somewhat vascular, but no bleeding was evident after rubbing with a cotton applicator. The area was not tender to touch, and the patient did not complain of pain associated with this mass. There was heavy staining of the teeth and an abundant amount of dental calculus.

Extraoral Examination.—There was a firm, freely movable mass about 1 cm. in length in the left submental region. No other nodes or masses were palpated in the cervical, axillary, or inguinal regions. The liver and spleen were not enlarged. The results of the general physical examination, including the skin, were within normal limits.

Roentgenographic Examination.—No abnormal findings were reported in the dental roentgenograms and chest films.

Laboratory Tests.—Urinalysis, complete blood cell count, and differential blood cell count were all within normal limits.

Biopsies.—Biopsy specimens were taken from the mucoperiosteum in three separate areas of the palatal and buccal gingival mass (Fig. 3). The submental node was excised.

Microscopic Description.—All of the specimens of the oral mucosa showed similar changes. The stratified squamous epithelium was in some areas hyperplastic and in other areas thin and densely infiltrated by atypical lymphatic cells. The corium showed a dense diffuse infiltration by lymphoid cells with ovoid, kidney-shaped, or angular nuclei and scanty cytoplasm. Atypical mitoses were frequent. The tumor cells completely obliterated the connective-tissue stroma of the corium (Fig. 4).

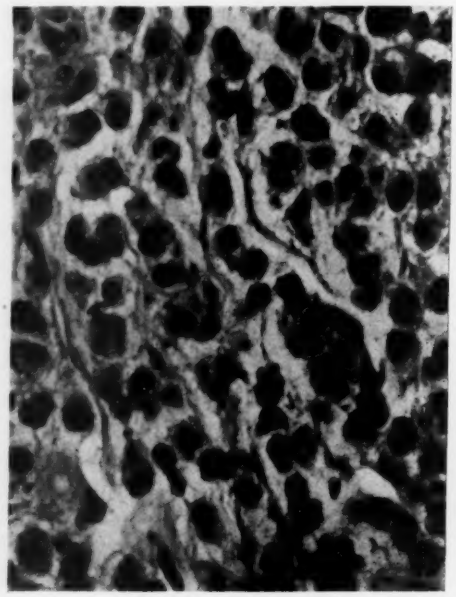
In the excised submental lymph node the normal architecture was largely replaced by a diffuse dense accumulation of lymphoid cells similar to those found in the oral mucosa. The infiltration extended into the connective tissue of the capsule.

Microscopic Diagnosis.—Lymphosarcoma of the oral mucosa and submental lymph node.

Treatment and Course

In view of the microscopic reports the patient was immediately referred for radiation therapy. The circulating blood and bone marrow were examined at this time and reported to be within normal limits. Prior to radiation therapy the teeth adjacent to the area to be radiated were removed. One week following radiation therapy another blood examination was made and the results now showed 200,000 white blood cells per cubic millimeter, with a predominance of immature lymphocytes. Sternal puncture confirmed the diagnosis of acute lymphatic leukemia.

Fig. 5.—Photomicrograph of a case of chronic gingivitis. Note that infiltration consists almost exclusively of mature plasma cells arranged in rows between the bundles of connective-tissue fibers. Reduced ⅔ from mag. × 900.



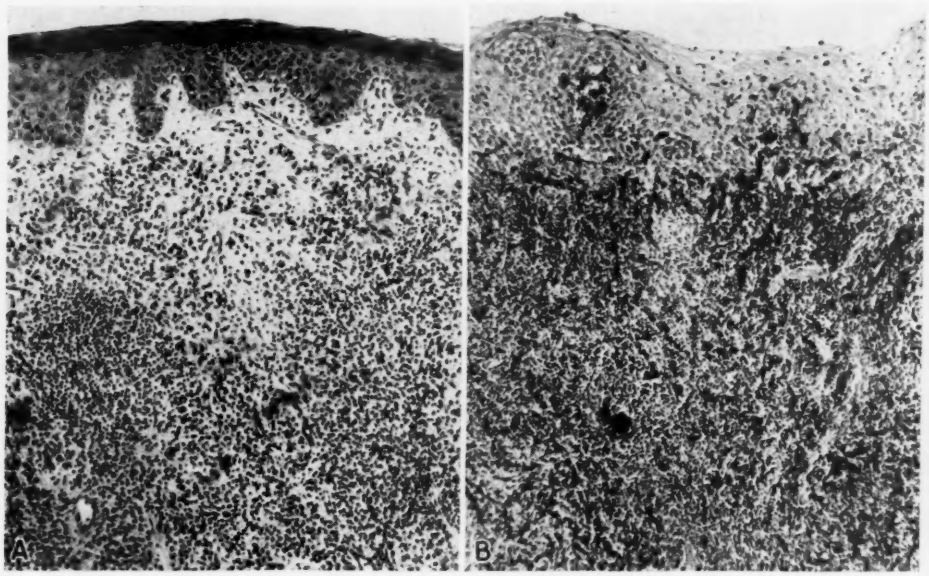


Fig. 6.—Photomicrographs of chronic gingivitis (*A*) and lymphosarcoma of the gingiva (*B*). Note the uniformity in the staining of the nuclei of the infiltrating cells in *A* and the polychromasia in *B*. Reduced 2/5 from mag. × 120.

The patient continued a downhill course and died in November, 1953, one year after the first manifestation in the oral cavity. Permission to perform a postmortem examination was not granted.

COMMENT

This report amply demonstrates the need to consider in the diagnosis of oral lesions not only local but also systemic diseases which frequently are manifested initially and early in the oral cavity. It has been known that transitions from lymphomas (lymphosarcoma, reticulum-cell sarcoma, giant-follicle lymphoblastoma, and Hodgkin's disease) to lymphatic leukemia may occur. Recently it has been reported [1] that such transitions occur more frequently than expected.

Chronic inflammation of the gingiva is present in an extremely large percentage of the population. Microscopically this lesion is characterized by an infiltration predominantly of plasma cells, preserving to some extent the connective-tissue framework of the mucosa (Fig. 5). The microscopic appearance of the frequent chronic inflammatory lesions should be distinguished from that of lymphosarcoma, which is characterized by a dense infiltration of immature lymphoid cells showing frequent mitoses and replacing the connective-tissue stroma of the mucosa (Figs. 1, 2, and 4). Even under low magnification the difference between chronic inflammation (Fig. 6*A*) and lymphosarcoma (Fig. 6*B*) of the oral mucosa might be discerned.

SUMMARY

A case of lymphosarcoma which was manifest initially and early in the oral cavity for 10 months before systemic findings were observed is reported. The correct diagnosis was delayed for four months because of misinterpretation of the microscopic picture of two previous biopsy specimens as a nonspecific chronic inflammation.

Photography by Mr. William M. Winn.

104 S. Michigan Ave. (Dr. Sarnat).

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MULTIPLE OSTEOMAS OF THE TRACHEA

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OF THE benign tumors of the trachea, one of the most rarely diagnosed is osteoma. The presence of the condition may never be detected, because only in the rather far advanced cases are any symptoms initiated. Usually the presenting complaint is brought about by mechanical obstruction of the airway. Most of the 90 cases reviewed by Dalgaard [1] were seen during autopsy as incidental findings, having produced no perceptible changes in the trachea to cause symptoms. The patient in the case reported had only minimal complaints, which included dryness and a tickling sensation in the throat.

The condition was first presented by Wilks [2] in 1857, when he discovered the growths in the trachea and bronchi of a 38-year-old man who died of pulmonary tuberculosis. Chiori * in 1878 described the tumor in a pathological specimen obtained by Rokitansky in 1855.

In Dalgaard's collection of cases, an analysis of the sex and age distribution revealed no sex predominance and even distribution among all ages above 30 years. The presenting complaints may be dyspnea, dryness of the throat, hoarseness, cough with or without expectoration, and hemoptysis, which may occur with pulmonary suppuration resulting from the chronic obstruction.[3] The condition, also known as tracheopathia chondro-osteoplastica, appears in the trachea as numerous small, warty, firm masses within the submucosa in close relation to the cartilaginous tracheal rings. The posterior wall of the trachea is completely free of involvement. The tumor masses may extend along the entire length of the trachea and on into the bronchi. Obstruction usually develops at the level of the lower trachea or in the bronchi. The mucosa is usually intact and noninflamed, unless secondary chronic suppurative bronchitis or bronchiectasis develops, when purulent material with or without signs of hemorrhage may be encountered.

The cause of the osseous tumors in the trachea and bronchi is unknown. Many hypotheses have been suggested. They may be a product of exostosis, a congenital anomaly, an alteration of the elastic tissue elements or other connective tissue of the trachea.[4] Jackson and Jackson believe that the growths may be of inflammatory origin and brought about by chronic irritation.[5] Dalgaard mentions the ecchondrosis theory as a possibility when the tumor masses are intimate with the tracheal rings having been built through the activity of the perichondrium but explains that this could not be true if they were derived from elastic cartilage. In a case he presents he believes that the elastic cartilage arose directly from the elastic connective tissue through direct metaplasia and that this elastic cartilage had the ability to calcify and ossify partly by means of osteoblastic activity.[1]

Therapy is purely supportive, which includes removal of any obstructive masses as they occur. It has been suggested that a trial of irradiation as an attempt to arrest the process may help. In Clerf's case,[4] a 750 r tumor dose was delivered to the trachea in an effort to control hemoptysis. A nine months' follow-up was reported, without recurrence of bleeding and no change in the gross appearance of the lesion.

From the Otolaryngology Service, Department of Surgery, Letterman Army Hospital, San Francisco.

* Chiori, H., cited by Dalgaard.[1]

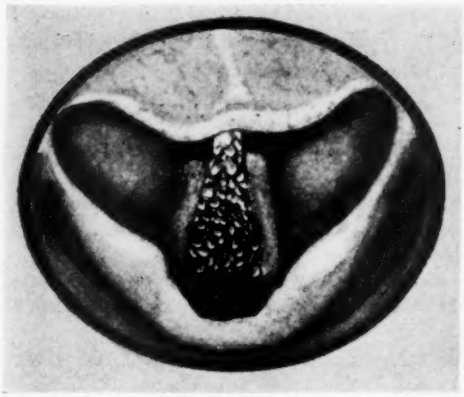

Fig. 1.—Illustration simulating mirror view of larynx and trachea showing innumerable papillomatous growths on anterior and lateral walls of the trachea.

REPORT OF A CASE

A 60-year-old white woman was referred to the Ear, Nose, and Throat Clinic because of vague tickling sensations in her throat causing an intermittent nonproductive cough for several months. This complaint along with a frequent feeling of a lump in the throat produced a cancerophobia. Her past history, which revealed numerous ailments, including hiatus hernia, duodenal ulcer, and gallbladder disease, plus a harrowing four years' experience in a Japanese concentration camp during World War II, led to an impression of globus hystericus.

On indirect laryngoscopy there were seen numerous small papillomatous growths on the anterior and lateral walls of the trachea extending downward as far as could be seen, grossly narrowing the airway. The larynx appeared entirely unaffected (Fig. 1). First impression was carcinoma of the trachea. Lateral cervical soft tissue x-rays revealed calcified "grape-like" lesions in the subglottic region extending from about C-6 to T-1 (Fig. 2).

Fig. 2.—Lateral cervical soft tissue x-ray showing calcified grape-like lesions in the subglottic region.

Fig. 3.—Photomicrograph of tracheal growths showing fragments of mature bone, including osteocytes, Haversian systems, and small portions of apparent bone marrow.

On bronchoscopic examination in the subglottic area, but not involving the posterior tracheal wall, there were seen innumerable small, smooth, nonulcerated excrescences measuring from 1 to 5 mm. in diameter, which appeared to be attached to the tracheal rings; they continued to a level approximately 2 cm. above the bifurcation and were especially dense on the right side. There was no sign of involvement of the bronchi. Biopsy specimens were removed with a cupped forceps; the individual masses clipped off easily, being hard in consistency and producing a gritty feel through the forceps. There were no masses causing any apparent obstruction of the airway.

Microscopic examination of the biopsy specimens showed slightly lobulated fragments of mature bone, including osteocytes and Haversian systems and small portions of apparent bone marrow. The bone fragments were surrounded by a small amount of fibrous tissue. The specimens were surfaced by ciliated pseudostratified columnar epithelium (Fig. 3).

The patient is being followed in the Ear, Nose, and Throat Clinic, where periodic examinations of the trachea are done. She was last seen Oct. 13, 1954, at which time there was no appreciable change.

Roentgenographically, the tumors present themselves as small, 1 to 5 mm. pyramidal, oval, or circumscribed densities of a cartilaginous-bony nature. Confusion with calcification within the thyroid gland may arise. The strict localization of the densities of tracheopathia chondro-osteoplastica to the confines of the trachea, together with their cartilaginous-bony characteristics, makes mistakes unlikely, however. Planographic studies in this case failed to reveal actual connection to the rings but is considered a procedure of value in some cases.[3]

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Clinical Notes, New Instruments and Techniques

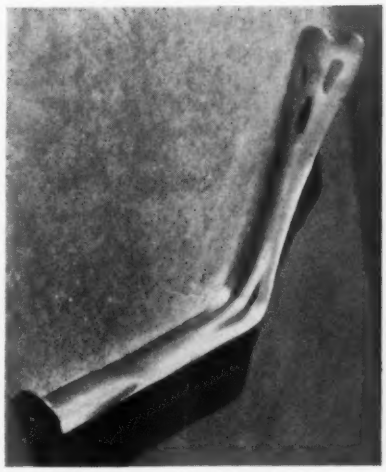
COMBINED TONGUE BLADE AND PALATE RETRACTOR

E. L. MANNING, M.D., Davenport, Iowa

An instrument having one blade made as a tongue blade and the other as a Love palate retractor has been used by me for the past year and found very useful.

In doing an adenoidectomy the Love uvula retractor gives a good view of the nasopharynx, and both it and a tongue blade are used continually. Having both in one instrument keeps them both at hand and available. It has been of help not only for surgery but as an office instrument.

It has been mentioned that one needs to use palate retractor and tongue blade at the same time and should even use an assistant to do a proper adenoidectomy. It was the intention that one should have a number of these instruments available to entirely replace the metal tongue blade so that one always has the palate retractor at hand.



Combined tongue blade and palate retractor.

The instrument was made for me by the Storz Manufacturing Company.

1020 First National Building.

NEW SUCTION PERIOSTEAL DISSECTOR

BENITO B. RISH, M.D., New York

The advantages of a dry field in surgery have long been appreciated by every surgeon. This is particularly desirable in nasal surgery. We usually rely on the production of partial hemostasis by the injection of anesthetic agents containing epinephrine and on the use of suction apparatus. In submucous resections particularly, it is important to separate the septal mucosa with its attached perichondrium and periosteum from the cartilaginous and bony septum by the use of a periosteal elevator such as the types designed by Freer, Joseph, McKenty, etc. This mucoperichondrial and mucoperiosteal dissection demands a dry field. Inasmuch as the area available is very limited, it is often difficult for an assistant to apply suction to the field while the operator manipulates both the nasal speculum and the periosteal elevator. Very often an assistant is not available and the operator must complete the dissection by himself. This he can do by alternately using the suction tip to keep the field dry and the periosteal elevator to separate the mucoperichondrial and periosteal flap. Being able to use only one instrument at a time often forces the surgeon to accomplish his mucoperichondrial and periosteal dissection with the suction tip itself. Although this is feasible, it is not completely satisfactory.

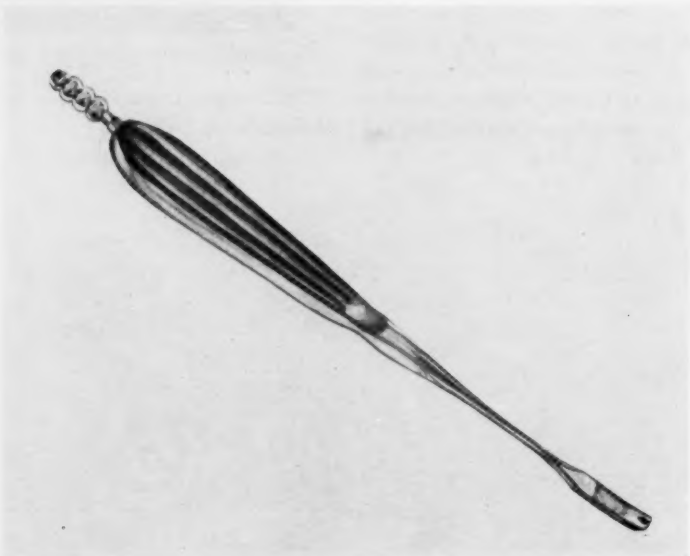
These inherent difficulties prompted the design and construction of a single instrument which would encompass both requirements, i. e., a combined periosteal elevator and suction tip. This new instrument is a Joseph-type periosteal elevator only very slightly heavier than the usual type, with a complete lumen originating at the most distal portion of the dissection head and terminating at the proximal end of the handle. At this point the suction tubing is attached.

Although this instrument was primarily conceived and designed for use in submucous resection work, it is by no means limited to this field, or even to the field of otolaryngology. It could also be a valuable addition to the armamentarium of the orthopedic and plastic surgeons and the neurosurgeon, and may be used in any situation where perichondrial or periosteal dissection is desired.

Chief, Section of Otolaryngology, Veterans Administration Hospital, Brooklyn.

860 Fifth Ave. (21).

Rish suction periosteal dissector.



NEW PERICHONDRAL ELEVATOR

JOSEPH R. RONGETTI, M.D., New York

The bleeding occurring during submucous resection, when this operation is done as part of the nasoplasty procedure, has frequently been troublesome. This portion of the nasoplasty procedure is usually done as a final step, at which time the vasoconstrictor effect of topical cocaine and epinephrine has been lost. Consequently, perichondral elevation must be repeatedly interrupted by intermembranous suction.

To obviate this repetitious change of elevator to suction, a metal suction tube (Fig. 3) with cup-shaped elevator tip (*A*) was designed, which would give continuous suction during the act of perichondral elevation. In order that the cup suction tip would not create too great a vacuum, thereby locking itself against the exposed cartilage, a small vent measuring 1 by 2 mm. (*B*) was drilled just posterior to the open face of the elevator cup.

The instrument is manufactured by A. Klenk, Instrument Co., Maspeth, L. I.

From the Division of Head and Neck, of the Surgical Service, St. Vincent's Hospital.

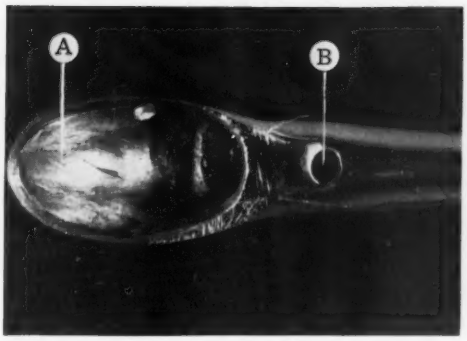


Fig. 3.—Close-up anterior view of elevator suction tip (*A*). Small vent inferior to cup suction tip, acting as negative pressure release, preventing locking of cartilage to suction tip (*B*).

The instrument has been used with advantage in the classic submucous resection and as a curette during the final stages of ethmoidectomy. It has also proved to be of value in the subperichondral dissection of hemilaryngectomy and laryngofissure.

42 Fifth Ave. (11).

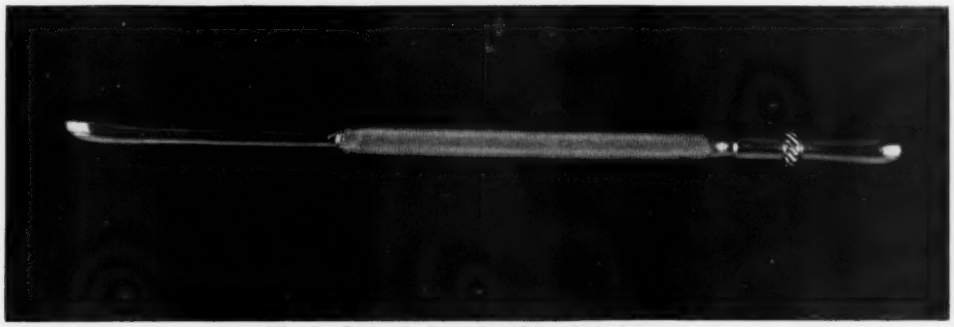


Fig. 1.—Lateral view of perichondral elevator.

Fig. 2.—Anterior view of perichondral elevator.

Progress in Otolaryngology

PLASTIC SURGERY

Summaries of the Bibliographic Material Available in the Field of Otolaryngology for 1952 and 1953

LYNDON A. PEER, M.D.
AND
JOHN C. WALKER Jr., M.D.
NEWARK, N. J.

NASAL GRAFTS AND IMPLANTS

A PANEL discussion on "nasal implants" was an interesting part of the program at the recent meeting of the American Academy of Ophthalmology and Otolaryngology in New York City. The members of the panel, Dr. John Converse, of New York, Dr. Oscar Becker, of Chicago, and the senior author of this review, were in close agreement regarding the clinical value of various implants and tissue grafts which may be used to correct nasal contour defects. Implants were defined as nonliving substances, and grafts were considered to be fresh organic tissues with living cells. Thus, preserved cadaver cartilage and possibly frozen dried cartilage (if the cells are nonviable) are implants, whereas fresh cartilage, fresh bone, and the like are grafts. All panel members agreed that autogenous cartilage and autogenous bone are the most satisfactory grafting materials. Preserved bank cartilage implants and fresh homogenous cartilage grafts were held to be valuable substitutes when it is not good judgment to use the patient's own tissues.

Dr. Converse emphasized the value of autogenous iliac bone grafts for severe degrees of saddle nose and for depressions of the facial bones due to trauma. He expressed preference for autogenous rib cartilage grafts to repair less extensive nasal depressions.

Dr. Becker suggested the use of preserved alar cartilage to "cap" or cover an autogenous rib cartilage graft. The alar homograft is gradually replaced by host fibrous tissue, which is advantageous because the replacement connective tissue provides a soft even contour for the dorsal line of the repaired nose.

Peer stressed the advisability of always using concealed incisions through the mucous membrane for the insertion of cartilage or bone to support saddle nose deformity. When a strut in the columella is required, it may be inserted through an incision in the buccal mucous membrane. This strut should be anterior to the beam of cartilage supporting the dorsum of the nose to avoid a "beaked" appearance at the nasal tip. The cartilage strut inserted through an incision in the buccal mucous membrane is also extremely useful for the correction of a retracted columella, which may result after accidents or radical rhinoplasties.

Cartilage Grafting

Of all buried grafts cartilage is probably the most widely used. It is unique in that it adapts itself to almost any tissue environment, provided it is completely surrounded by nourishing host tissue and not exposed. Unlike iliac and rib bone grafts, it survives equally well whether in contact with like tissue (cartilage) or some other tissue, such as fat, muscle, or fascia.

The available clinical and experimental evidence regarding the fate of the various cartilage grafts should enable a surgeon to choose rather definitely between autogenous and homogenous cartilage according to the requirements of any given case.

Fresh autogenous cartilage is always the material of choice for transplantation. The cells in autogenous cartilage grafts survive transplantation as living cells, which continue to maintain and service their intercellular matrix. Occasional grafts may be partly absorbed, especially in children or in avas-

cular transplantation sites, but the amount of absorption is less than that which occurs in homogenous grafts for a particular person. Curiously, one notes that preserved homogenous grafts may be completely absorbed in avascular scarred sites, whereas autogenous grafts tend to remain when transplanted in the same locality at a second operation.

Homogenous cartilage, either fresh or preserved, is a valuable second choice when it is not expedient to remove the patient's own cartilage.

Autogenous cartilage is especially indicated in children and young adults, who have a long life expectancy and therefore require longer-lasting grafts than do elderly patients. When large amounts of cartilage are required, as in the reconstruction of both ears in young children, cadaver cartilage may be used together with as much autogenous cartilage as can be obtained.

It is sometimes good judgment to use cadaver cartilage to support saddle nose deformity in children or to build out a receding chin (micrognathia), since a second graft may be employed if the original transplant is absorbed. Contrariwise, it is never good judgment to use cadaver cartilage entirely for the structural support of a new auricle in spite of opposite statements. If the cadaver transplant for an auricle undergoes absorption after a split graft has been used to cover the back of the auricle, the covering skin will contract to such an extent that further reconstructive work may not be possible.

The cells in fresh homogenous cartilage grafts survive transplantation as living cells, but the matrix is slowly absorbed by host fibroblasts and the exposed chondrocytes disappear. Clinically preserved homogenous grafts retain their structure about as well as fresh homogenous cartilage grafts, but bank cartilage is preferred because it is more readily available. Absorption and replacement by connective tissue or bone may occur in both autogenous and homogenous cartilage grafts, but the tendency is greater in the foreign graft.

Heterogenous cartilage grafts from the ox, giant sting ray, or shark have little if any place in clinical surgery at this time.

BONE AND CARTILAGE

As explained by Grocott,[1] the recipient area in cranial bone grafting is carefully prepared by sharp dissection of the periosteum from the margins of the defect and freshening the bone edges. The graft is carefully patterned, gussets being cut in the edges to increase curvature. The compact bone surface is placed in contact with the dura. A shelf of compact bone is prepared on the margin of the graft and inserted beneath the margin of the defect to facilitate a better fit.

Five cases of cranial bone grafting are reported in which autogenous bone from the iliac crest was used. No intracranial disturbance occurred in any of the patients. The illustrations indicate excellent postoperative results in all cases.

Lewis [2] reports on a series of 107 patients in whom autogenous chipped cancellous bone from the iliac crest was employed in close contact with bone. Its application is illustrated in bone loss of the mandible, in pseudarthrosis of the mandible, in cranioplasty, in rhinoplasty, in contoural deformities of the mandible, and in loss of the premaxilla. He considers the ultimate cosmetic, anatomic, and physiologic results to be excellent.

Kiehn and Grino [3] give illustrative cases of ill effects from the use of tantalum plate, as erosion into the right orbit from placement of this foreign body in frontal soft tissue and bone; as recurrent headaches caused by the tantalum plate in extreme heat or cold weather, and in epilepsy and headaches and improper contour from the alloplastic transplant in loss of an eye and periorbital, frontal, and temporal bone. There is the added danger of infection from the sinus in placing tantalum in the frontal region. In these patients removal of the plates relieved their symptoms. The deformities were corrected with autogenous iliac bone grafts, the size and shape of which can be determined by a plaster cast of the defect before operation. As the defect is approached, care should

be taken not to expose the frontal lobe, as it is covered with a false membrane encapsulating the tantalum plate. This is left attached to the brain but dissected away from the edge of the defect so that the graft will come in contact with the skull.

Dingman,[4] of the University of Michigan, believes that autogenous and homogenous cartilage generally fail to give adequate protection to the brain in cranioplasty and frequently give a poor esthetic result. He considers fresh autogenous iliac bone superior to other materials. In all of 30 patients except 1 the iliac cranioplasty was done as a secondary procedure for the correction of a preexisting skull defect caused by injury, neoplasm, or infection.

The skull defect is exposed and the bone margins prepared by one operative team, while the other team is removing the bone from the donor site. If possible, the incision is made through the scalp. The margins about the defect are exposed by retracting pericranium and dura. A cast stone model is made to ascertain the size and shape of the graft needed. If large bone grafts are required, the full thickness of the ilium is taken and the bone is split after removal. The graft margins can be contoured and fitted to the skull defect by the use of rongeurs, dental drill, a small rotary saw, or large dental bone burs. The graft is held in position with Stainless Steel wires passed through drill holes in the graft, and through the margins of the bone defect. If any small areas of the graft are not in contact with the bone margin, the small bone chips removed during the process of contouring the graft may be packed into the marginal defect. The grafts show a slight degree of decrease in density after a period of three to four months. No complications have developed; the longest follow-up was three and a half years. The contour and function have been excellent.

Lewin [5] discusses the facial deformity and clinical picture of acrocephaly (oxycephaly). He reports a case in which the facial appearance was greatly improved by filling out the depressed infraorbital area of the underdeveloped maxillae with a graft of bone chips taken from the iliac crest, plus a corrective rhinoplasty to straighten and narrow the nasal bridge. To improve the appearance further, the eyebrows were extended toward the midline with eyebrow pencil.

Edgerton [6] expresses the opinion that operation for encephaloceles and meningomyeloceles should not be withheld only because of the fear that neurological damage might become severer later. Many children with very severe deformities and permanent loss of function as a result of an extensively damaged central nervous system may not have their lot greatly improved by recent reconstructive methods. However, more of these children may be left relatively normal today than was possible a few years ago.

Utilization of well-known plastic methods makes gaining a one-stage reconstruction of the larger defects feasible. Bone flaps and grafts add appreciably more surgical danger and shock to the operative procedure, and Edgerton has not often employed them for spina bifida. If bone repair is needed, a homograft of thin rib or cranial bank bone is easily applied, readily accepted by the tissue, and is naturally curved to accommodate the neural elements beneath. Fascial flaps may be turned over the bony defect by using musculofascial pedicles on both sides of the midline. If the sac is excised in a transverse axis a single broad, double pedicle flap raised from the normal skin just cephalad to the defect is shifted downward to lie over the muscle flaps. A split-thickness graft taken from one buttock is sutured in the donor defect.

Much the same principles are followed in the treatment of encephaloceles. The dural closure may require a graft of fascia lata. If the skin covering is inadequate, pedicle flaps may be needed. In a patient with a very rare type of encephalocele involving the orbit, Edgerton used homogenous bank bone, preserved in aqueous thimersal for 14 months, to repair the defects. The graft has remained firmly in place and shows excellent bony union. The child has grown considerably, and there has been no evidence of recurrence of the encephalocele.

When bovine cartilage is employed as a reparative material in plastic surgery the results are likely to be disappointing. In 12 patients in whom bovine cartilage was implanted by Gibson and Davis,[7] 10 grafts were absorbed within two years. A second surgical implant in one patient was found to be destroyed more actively and more rapidly than the first. Histological examination showed development of marked systemic response to bovine cartilage. This suggests that an antigen-antibody reaction might be responsible for the absorption. In a small series of experiments on human volunteers, each successive implant showed a degree of absorption greater than the preceding. In the first stage of the body's reaction against the foreign substance, the edges of the cartilage become eroded and collagenous tissue replaces the portions absorbed. Replacement by fibrous tissue is followed by liquefactive dissolution of the cartilage by the host tissue.

The reaction of the body has been directly proportional to the time that the host has been exposed to cartilage in an antigen-antibody response. The histochemical studies by Gibson and Davis suggest that hyaluronidase has little or no importance in the absorptive process.

Experiments made to determine the surface area of different types of implant of the same weight are illustrated diagrammatically. The antigenic activity of this relatively insoluble material is related to its surface area. The long survival of block implants is considered to be due to their relatively small surface area and also to their fibrous encapsulation.

Evidence is produced which suggests strongly that the reaction to bovine cartilage is quite specific. That there is an indivdual specificity from animal to animal within a given breed appears unlikely; it is much more probable that the specificity is one of breed.

The authors believe that diced implants and thin sheets of bovine cartilage are unlikely to survive for a time sufficient to justify their use. They conclude that if a bovine cartilage graft is absorbed it is probable that it will be useless to replace it with a further implant from the same batch. A reasonable possibility exists, however, that a second graft will be as successful as the first if the cartilage used is derived from a different source.

North,[8] of Oxford, presents a further follow-up study of patients in whom implants of bovine cartilage had been used for contour restoration since 1948. An analysis of the results of 205 solid grafts of preserved bovine cartilage was made. The clinical evidence indicates that the use of bovine cartilage as a routine grafting material for the restoration of contour is attended by a high chance of later absorption, even when the graft is initially successful. This chance is particularly great in children, and when the material is used as a support for the reconstructed ear.

North's observations on the results of later introduction of a second graft argue against any specific sensitization to bovine cartilage.

In histological studies the specimens of bovine cartilage showed a considerable number of channels containing capillary-like vessels lined by a single layer of flattened cells; in the unprocessed specimens these vessels were seen to contain red blood cells, but in the processed specimens no red blood cells were seen.

SKIN GRAFTING AND SCARS

As stated by Kitlowski,[9] the differential diagnosis between a keloid and a keloidal or hypertrophic scar is essential for the proper treatment of both conditions. A keloid is a fibroma usualy of the fibrous tissue of the corium. A keloidal scar is contracted fibrous tissue which can be aggravated by the resulting contracture of the surrounding skin, causing it to thicken and simulate keloid. A patient must have a tendency to keloid formation to produce the growth. The etiology of keloid and the tendency to keloidal scar formation is unknown and is probably due to varying degrees of faulty metabolism.

Scars which have contracted because of skin shortening become keloidal in appear-

ance and are most frequently diagnosed as keloids. Massage over a period of months (with castor oil) will cause a keloidal scar to soften, thus establishing a differential diagnosis. A true keloid will not soften under massage. Keloid scar formation can be minimized by removal of excess granulations from the surface to be grafted. It can be corrected by complete or gradual excision, shifting of neighboring tissue to relieve the tension, grafting with skin or flaps, depending on the situation.

The keloid is first given a roentgen-ray treatment, usually an erythema dose. The depth of the keloid is excised into normal fat and the margins undercut to relieve tension on closure. Care should be taken not to traumatize normal skin. If the patient has more than one keloid, postoperative roentgenotherapy is given, starting three weeks after operation. This method has resulted in 90% success, without recurrence.

The temporal flap has wide application in the correction of defects on the scalp, eyebrow, orbit, eyelids, cheek, nose, upper lip, and less frequently the lower lip, buccal mucosa, and chin, as stated by Conway, Stark, and Kavanaugh.[10] The color and texture of the skin of the temporal pedicle are similar to those of the recipient sites on the face. The multiple anastomoses of the frontal ramus of the temporal artery with the frontal artery and with the supraorbital artery of the same side, as well as with the same vessels of the opposite side, account for the excessive vascularity.

Diagrams of the variations in the outline of temporal flaps and arteriograms of the superficial afferent circulation of the head and neck with outline of pedicles commonly used in plastic surgery are presented.

The temporal flap incorporates the frontal branch of the superficial temporal artery. The sickle flap carries in it the parietal branch and the ascending portion of the frontal branch of the superficial temporal artery. These major vessels are united at the genu of the pedicle by anastomoses. The frontal and supraorbital arteries on both sides of the midline are included in the median forehead flap. The oblique forehead flap depends for its circulation upon the rich plexus of collateral vessels present upon the scalp. The "up and down" flap (Gillies) transects many major vessels and depends upon collateral circulation to furnish the tip of the pedicle. The modified "up and down" flap incorporates the frontal and supraorbital vessels bilaterally but depends upon collateral circulation to furnish the genu of the pedicle.

It was considered inadvisable by Robinson [11] to replace the avulsed scalp either as a whole or thinned down to a full-thickness graft, since it was not successful in any of the patients on whom it was tried. It is suggested that the treatment of choice is immediate cover of areas having a pericranial base with split-thickness skin cut with the dermatome. Small areas of exposed bone, present in 30% of the patients, should be treated by excision of the superficial compact bone and immediate Thiersch grafting.

Late reconstructive procedures, such as split-thickness grafts to the forehead and the use of hair-bearing flaps to remove or alter the position of bald areas, are described. Inadequately treated patients may show recurrent ulceration and severe scar contraction.

Neumann [12] made clinical and pathological observations after subcutaneously introducing pedicled flaps of dermis and fat for the restoration of contour in three patients with progressive facial hemiatrophy. While free grafts, either of dermis and fat or of bone and cartilage, previously attempted uniformly failed, the pedicled flaps of dermis and fat were retained without undergoing absorption and without developing any complications such as epidermal cysts. Establishment of firm union between the dermis of the flap and that of the facial skin was revealed in specimens of tissue removed for histological examination. The sebaceous glands completely disappeared, and the number of hair follicles and sweat glands from the flap markedly diminished. In addition, a minimal inflammatory reaction of a few small collections of lymphocytes and foreign-

body giant cells was present about microscopic remnants of hair.

Conley [13] points out that the chief causative factor in the precipitation of carotid artery hemorrhage comes from the use of irradiation in the attempt to cure or control metastatic cancer of the neck.

Indications for and a technique of the use of various chest and neck flaps, facial and clavicular tissue flaps in the neck are presented for the prevention and treatment of carotid artery hemorrhage. These flaps should contain skin, subcutaneous tissue, and platysma muscle. They bring into the area new blood supply and covering for devitalized and necrotizing areas of the neck.

In partial loss of the scalp, unless the loss is more than approximately 50%, Kazanjian [14] finds it possible to minimize or completely eliminate the hairless areas by judicious distribution of the remaining hairy scalp over the head by a series of operations. A process of free undermining of the surrounding hairy scalp, advancing it as far forward as possible, and, after excision of a measured amount of hairless skin, suturing the hairy scalp into the new position may be repeated until maximum stretching of the hairy scalp is obtained. If raw areas are created, they should be skin-grafted.

Kazanjian diagrammatically illustrates an oval-shaped hairless area repaired by bipedicled flaps from each side of the defect. In round scalp defects a single or double rectangular flap will divide the hairless area into smaller sections, which are more readily repaired. Use of advancement flaps is combined with suturing the smaller hairless areas between the hairy skin.

Figi,[15] of the Mayo Clinic, reports on the varied uses of free skin grafts in the mouth and application of such grafts, emphasizing the satisfactory "take." The principles of skin grafting within the mouth have changed little since its introduction approximately 35 years ago. Antibiotics are used routinely unless there is contraindication. In this restoration it is necessary to hold closely to established principles of plastic surgery.

In his experience postoperative and post-irradiation deformities resulting from the treatment of oral neoplasms accounted for the largest number of patients in whom intraoral skin grafts were used.

Technical aspects are stressed, such as a thin graft as free from hair as possible. Figi goes on to say that if teeth are present in the alveoli of the involved jaw, most satisfactory immobilization of the stent supporting the graft is furnished by an appliance that can be attached to a dental shell cemented to these prior to operation. In edentulous patients adequate fixation is secured by passing nonabsorbable surgical (silk) mattress sutures through the cheek, lips, submental or submaxillary region and tying the ends over a large gauze pad on the cutaneous surface after engaging the graft-covered stent in the loop of these sutures inside the mouth. Sponge rubber serves well as a stent when immobilization with transfixing mattress sutures is required. In general, the stent supporting the skin graft is left undisturbed for about 10 days. Prompt replacement of the stent with an acrylic prosthesis is essential. Depending upon the thickness of the graft, the prosthesis must now be worn continuously for at least several months.

Ragnell [16] recommends a method of reconstruction of the supporting tissue alone in patients with retroposition of the nasomaxillary complex which appears to be congenital or possibly datable to earliest childhood.

An incision is made along the median line in the undersurface of the columella from a point immediately behind the nasal tip to a point below the base of the columella in the lip. The nasal soft tissues over the nasal bridge are undermined to the frontal bone and extensively lateral toward the tubera maxillae. A boat-shaped autograft and a small columella support are taken from the crest of the ilium. Bone chips obtained from the crest of the ilium of the same side are packed in the pockets on the anterior surface of the maxilla from the small opening in the columella. The cushion of bone chips is modeled to an even surface. The block graft for the nasal bridge is introduced from

the columella incision, and likewise the columella support, which is placed on the cushion of bone chips.

Several illustrative case histories are included.

Frackelton [17] advocates excision of scars to simulate facial wrinkles in a corresponding area of the opposite side of the face. He demonstrates corrections of facial paralysis by fascial strips from the temporal muscle to the eyelids, from the masseter muscle to the lips, and with nasolabial and forehead incisions to simulate facial wrinkles.

Pierce and his colleagues [18] suggest reconstruction of the lips that satisfies the requirements of anatomy and physiology for both the partial and total loss, either of covering or of lining or both. After scars about the mouth and right upper lip had been excised, a flap raised from the right nasolabial fold was transposed to form the covering of the right side of the upper lip. In ectropion of both lips a tubed pedicled flap from the anterior hair-bearing neck region was used to fill the defect. In subtotal full-thickness loss, removal of the lower lip by "V" excision was repaired by "Z" plasty in the mucosa. In several instances microstomia was corrected by the use of a flap of mucosa or nasolabial flaps, with satisfactory results. The authors point out that there is still room for improvement in reconstructive surgery of the lip.

Kleitsch [19] reports on four patients who suffered injury and loss of facial tissues. A loss of the left malar bone was replaced by a Vitallium prosthesis which gave adequate support to maintain the artificial eye in a normal position, with satisfaction to the veteran. After a plastic revision of facial scars and insertion of a Vitallium malar prosthesis to replace loss of the left malar bone in another patient, exposure of the lower edge of the malar prosthesis two and a half years later was covered by an upper cervical tubed pedicled graft, which healed well and was nonadherent after two years. In both patients previous efforts had been made to restore the malar prominence by means of cartilage, free fat, and fascia grafts, without success. In another veteran, who had had a left mandibulectomy and neck dissection for a malignant ameloblastoma, a Vitallium prosthesis was inserted to replace the left half of the mandible and the left temporomandibular joint. In a fourth patient the nasal septum in a soft flabby nose reacted to a Vitallium prosthesis supporting the tip of the nose, necessitating removal of the prosthesis.

FACIAL PARALYSIS

In a Symposium on Facial Paralysis, Lathrop,[20] of the Lahey Clinic, emphasizes that experience with more than 200 patients with traumatic lesions of the facial nerve has demonstrated that much can be done through proper management. An adequate history, clinical examination, electrodiagnostic tests and other special laboratory studies, and observation and manipulation of the palsied side of the face permit assessment of the facial paralysis and the injury to the facial nerve. A positive electrical reaction obtained with faradic current or by electromyography suggests that the prognosis for spontaneous recovery is good, while a negative reaction merely indicates that the facial nerve is interrupted but does not distinquish between physiologic and anatomic discontinuity of the nerve. Galvanic electric tests permit evaluation of the ability of the paralyzed facial muscles to contract.

Lathrop states:

> In every case in which the available data indicate that improvement of the facial paralysis might be obtained from appropriate treatment, the facial nerve should be explored unless the facial paralysis followed trauma to the head without evidence of fracture or of surgical procedures in which the facial nerve is known to be anatomically intact at completion of the operation and temporary facial palsy is not uncommonly expected.
>
> When exploration reveals that the facial nerve has been divided or so badly traumatized as to require excision of the injured segment, the anatomical continuity of the nerve must be restored whenever possible by end-to-end suture or nerve graft.

When facial paralysis follows an operation or skull fracture, the paralysis of the face must be alleviated by other measures. When

the central end of the facial nerve is inaccessible, anastomosis of the distal stump of the facial nerve to the central end of an adjacent motor nerve is necessary, the spinal accessory or hypoglossal nerves being admirably suited for this purpose.

When none of these procedures are applicable, improvement can be obtained by the transplantation of pedicled strips of adjacent muscle innervated by the fifth cranial nerve or by mechanical support of the paralyzed side of the face. When the support is to be permanent, the use of slings of fascia lata gives superior results.

Participating in the same symposium, Bunnell,[21] after reviewing many articles on the management of facial paralysis, feels that there is no conception of the real cause of the condition.

The facial nerve is unique in that it is enclosed from the geniculate ganglion to the stylomastoid foramen in a close-fitting tunnel. Swelling of the nerve in the closed tunnel from any traumatism squeezes out its own blood supply, thus resulting first in ischemia, then necrosis, and finally fibrosis. Prompt decompression will keep the nerve alive. If decompression is not done then, the ischemia will result in a degree of damage to the nerve ranging from temporary palsy to permanent paralysis. In late cases decompression has been of value, but results vary according to the amount of damage in the nerve. After Bell's palsy, if the nerve appears on exposure to be in good condition, decompression and neurolysis should be sufficient, but if it appears reduced to a fibrous cord, then this segment should be excised and the nerve sutured after rerouting or else replaced by a nerve graft.

Under electric stimulation the degree of response of the reaction of degeneration is lessened.

Bunnell believes that advances in electrodiagnosis and electromyography may offer considerable gain, that rerouting where possible is better than nerve grafting, and that direct suture is needed unless nerves can be merely laid accurately in a channel. He prefers the sural nerve for grafting.

There are many cases of paralysis of the seventh cranial nerve that are unsuited to nerve repair, as pointed out by McLaughlin.[22] Facial paralysis after radical removal of a malignant parotid gland, in certain middle fossa fractures, in persistent congenital lesions, in birth injuries, or in long-standing palsies, is best suited to plastic surgery. He believes that when there is very slow natural recovery it may be wise to give temporary support.

In McLaughlin's technique of dynamic support, fascia lata is drawn through a hole

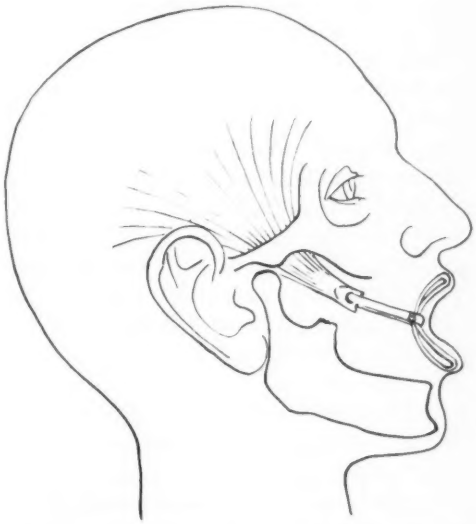


Fig. 1.—Diagram of temporalis sling showing relationship of transplanted temporalis and fascial slings. (Reproduced by permission from McLaughlin, C. R.: Plast. & Reconstruct. Surg. **11**:302, 1953, Williams & Wilkins Company.)

drilled in the coronoid near the apex, and the coronoid is divided a little below the hole. Both ends of the fascia are brought through a single subcutaneous tunnel down to the figure eight at the corner of the mouth.

He illustrates the relief of ectropion of the lower lid by an overlapping lateral tarsorrhaphy, designed to elevate the lower lid and to draw it in a lateral direction. The lacrimal opening is enlarged by a three-snip procedure on the canaliculus. In the worst cases internal canthoplasty by means of a transposition flap is useful.

Clarkson [23] uses both the neck and the intraoral approaches for masseter transfers. He transfers the anterior inch of this muscle as a first step, inserting it into the mucous membrane at the angle of the mouth. At a later stage he passes a fascia lata sling (preserved ox fascia) down from the temporal fossa around the anteriorly displaced masseter and then back to the temporal fossa.

In Battle's technique [24] one fascial sling is arranged around the mouth in a figure eight after Kilner. A second fascial loop is passed from the cheek beneath the fascia at the corner of the mouth, connecting the mouth sling to the parotid fascia, and a third loop from the zygomatic region is passed beneath the fascia at the corner of the mouth and is attached to a flap of the temporal muscle.

In Matthews' operative procedure the masseteric transplant is attached to the fascial sling at the angle of the mouth, while the slip from the temporal muscle activates the eyelids. In 11 out of 15 patients operated upon the improvement was sufficient to enable them to get about happily and without embarrassment.[25]

EAR

After burying shaped cartilage for external ear reconstruction and allowing time for encapsulation, Pierce and his colleagues [26] suggest dissecting the skin over the cartilage as a flap and using the skin from the back of the normal ear and the contiguous scalp as a free full-thickness graft, and the previous flap as lining for the sulcus behind the constructed ear.

May [27] points out that a small hole in the concha can be reconstructed by transfer of a retroauricular double-pedicled flap, elevated in stages. Defects of the rim of the helix and part of the anthelix, larger and total defects of the external ear are reconstructed with flaps from the mastoid region or, if the skin in this area is destroyed, with skin transplanted either from the cervical region or from the median surface of the upper arm.

May advises carving the concha from autogenous rib cartilage or shaping bank cartilage to as nearly normal condition as possible. In protruding ears the object must be the restoration of the ridge of the anthelix. If the protrusion is due to too large a concha, the anterior surface of the lateral part of the cartilage is undermined, slid over and behind the median part, and anchored in this position with sutures to the periosteum of the mastoid process.

Steffensen [28] summarizes the method used at the present time for total reconstruction of the microtic ear. In the first stage the curled, deformed cartilage is excised with the preservation of as much of the microtic ear as might be useful for making a lobule. In the second stage a preserved cartilage graft with sharp contour is implanted, with multiple perforations of the scapha which aid in the subsequent accentuation of the helix due to scar contraction pulling in the skin. In the third stage the implanted cartilage is elevated along with its attached anterior skin and a thin layer of fibrous tissue covering its posterior surface. A long triangular flap from the mastoid region is mobliized to the posterior surface of the ear. The base of this flap is posterior and adjacent to the lobule. The tip of the flap is attached to the upper pole of the sulcus, and its posterior surface is sutured into the depth of the sulcus. The remaining raw surfaces of the ear and postauricular region are covered with split-thickness skin grafts. The advantages of the method appear to be accentuation of the helix due to greater depth of the scapha and maintenance of a more desirable auriculocephalic angle.

A method suitable for construction of the helix on an otherwise normal ear is described by Cronin.[29] He utilizes skin shifted from the back of the ear and a cartilage implant. No failures have been encountered with this method in eight operations. In another method suited to formation of a helix on a totally or subtotally reconstructed ear, a narrow, overlapping marginal flap lined with a thick skin graft is used. Three helices have been constructed by this method.

In Carver's procedure [30] two single pedicled folding flaps are used in reconstructing

the ear lobule. The anterior flap, as thick as possible, is taken from the posterior aspect of the ear and rotated forward to become the anterior aspect of the new ear lobule. A second flap based in the posterior auricular area is elevated obliquely from the readily available tissue below the angle of the mandible and rotated upward, covering the defect created by forward rotation of the first flap and also supplying the posterior aspect of the lobule. The flaps are sutured together. The cervical defect created by the second flap is closed by excising a skin triangle, mobilizing the tissue of the lateral margins, and suturing them together.

In the second stage the second flap is amputated at the tip of the lobule, and the tips of the two flaps are sutured together.

In a patient with congenital bilateral atresia of the external auditory canal and poor hearing since birth, Woodman [31] tried a two-stage procedure. First an endaural radical mastoidectomy was performed. Incision down to the bone showed no evidence of an external canal. The incus and malleus were malformed. Pieces of a skin graft removed from the abdomen were fitted into the cavity, placed along the perimeter of the wound, and allowed to drop toward the depth of the cavity, and were sutured at the outer edge, creating an external auditory canal. The early improved hearing soon lapsed to a level about 15 db. better than before the operation. In a second-stage operation fenestration was carried out; the flap was dropped back into place and remained viable. It was well molded to the external canal and free of the usual tissue reaction and secondary infection.

In the procedure for correction of protruding ear described by Becker,[32] all incisions in the cartilage are designed to follow the normal contours of the ear. A diamond-shaped piece is removed from the posterior surface of the auricular cartilage. The sulcus anthelicis transversus is incised completely through. The cauda helicus is then partially removed unless the deformity is completely confined to the upper portion of the ear. The superior crus may, in the occasional patient, be cross cut by incisions which do not completely pass through the cartilage. A small transverse section of cartilage is now removed from the upper end of the superior crus at its junction with the helix. When the cartilage is soft and pliable or when the protrusion is not too pronounced, no internal or external fixation sutures are necessary. A section of the excess skin is removed from the posterior surface of the auricle, and the margins of skin are closed.

In his technique, Vidaurre,[33] of Santiago, Chile, marks only the posterior surface of the ear with Bonney's blue ink and makes the outer line of the elliptical-shaped incision. The cartilage is incised completely through. With a dental spatula he undermines the anterior skin, and exposes a large portion of the concha. The elliptical incision of the skin is completed. The triangular fossa is made by a single cut beneath the skin through the cartilage, at the estimated location of the posterior crus of the anthelix. The external cut of the cartilage is anchored behind the internal cut or on the posterior surface of the conchal cartilage.

In modifying the usual techniques to recreate a normal anthelix in protruding ears, Straith,[34] of Detroit, devised a method based on the observations that protrusion was due to the absence of the fold of the posterior crus and that the crest of the anthelix and posterior crus form a smooth curve to the top of the helix.

The correct height of the concha and anthelix is obtained by the Davis and Kitlowski method, and accordingly the excess cartilage as seen anteriorly is removed. When the skin excision is made on the posterior aspect of the helix, as compared with the posterior aspects of the concha, the force pulling the helix toward the scalp is lessened. To prevent a sharp conchal rim a continuous 0000 nylon suture is run in two or three sections just back of the cut edges of the concha and helix.

EYE

Smith [35] believes that evaluation of observations in inspection, palpation, auscultation, subjective tests, and roentgenograms should

precede an outline of treatment of orbital wounds. Penetrating, sharp, small caliber objects often cause more damage to deep orbital structures than the surface wound indicates. Shock, occurrence of hemorrhage, nutrition, and infection influence the timing of surgery and selection of anesthesia. Extensive hemorrhages in the orbit occur as a result of indirect injury to the vessels of the orbit and surrounding parts or from intracranial vessels. Accumulation of blood behind the eye, which results in "compression herniation" of the globe, usually extravasates from the trunk of the ophthalmic veins, ophthalmic artery, or important vessels within the orbital apex.

To quote:

> Sympathetic ophthalmia may arise from retained fragments of the uveal tract. Cavernous sinus thrombosis, exophthalmos, pulsating exophthalmos, enophthalmos, muscular paralysis, foreign bodies and fractures add to the complications of orbital wounds.

Smith believes that prolonged open treatment of wounds in the orbital region causes excessive scar formation, prolongs disability, and increases deformity.

Free tarsal or free skin grafts are applicable in providing one layer of lid tissue if circulation of the adjacent flap is adequate. Large raw areas over the face, forehead, nose, and orbit should be covered promptly with free split-thickness grafts.

Selected case reports with illustrations are included.

Spaeth [36] presents case reports to illustrate various principles in the treatment of major ophthalmic defects. The technique of sliding flap correction (Imre) is illustrated as applied largely to those conditions which do not involve the full thickness of the lid. Spaeth further shows the repair and reconstruction of a lower and an upper lid in which partial destruction has occurred but where some normal lid tissue is still present, and in required reoperation because of a recurrence.

The technique for the correction of a subtotal loss of the upper lid is especially applicable to full-thickness defects where the conjunctiva, the tarsus, the orbicularis, and the skin are all deficient. The technique is described as scar resection and closure, forming a mucous-membrane pocket in the lower lid for the subsequent pedicled flap, which was moved into the correcting position 10 days after the mucous-membrane graft. The defect in the lower lid was repaired with a simple full-thickness graft of a size sufficient to cover that area where the mucous-membrane graft had been adherent.

Spaeth refers to cases demonstrating utilization of the full-thickness lower lid in the reconstruction of a portion of the upper lid, and transplantation of pregrafted mucous membrane with skin from the upper to the lower lid. The technique is described in a case of new reconstruction of an entire upper lid when the lower lid is normal; and a case of orbital reconstruction following an orbital evisceration is illustrated as repaired with pedicled flaps—one for the posterior surface, the other for the anterior surface, one folded over the other. Spaeth stresses the importance of the planning necessary for and peculiar to each individual case.

Callahan [37] has found Stainless Steel gauze, tantalum gauze, and tantalum foil of value in early fracture repair, and illustrates their use in several case reports. Cartilage has been used for late repair of orbital deformities, the autogenous type being preferable. For destruction and loss of the zygomatic arch, the author recommends the use of costal cartilage, and bone from the iliac crest for fractures and loss of bone in the floor of the orbit, the zygomatic region, and the area of the frontal sinus. A tantalum plate may be employed to replace the loss of the inferior orbital rim. A methyl methacrylate wedge is considered quite useful for floor fractures, especially in anophthalmos.

Berens and Smith [38] describe the surgical techniques used to solve the various problems of the contracted eye socket. The authors prefer true wax rather than Kerr's dental compound for the mold used in eye-socket surgery. They also describe operations to shift the conjunctiva when a sufficient amount of it is present, and the tech-

nique used when buccal mucous-membrane grafts are employed. A description of the usual method for restoring the entire socket with epidermal graft is included, important details in the dissection, in preparing the mold, and in taking the graft being stressed.

Sherman [39] first reviews the literature during the past hundred years on the methods of preventing or correcting the retracted eye socket, and concludes that a sufficiently large implant at the time of enucleation or evisceration is the chief means of preventing a retracted socket.

In his opinion the first step in correcting a retracted socket is the use of the late implant, if one is not already present. Implantation of a Wheeler grooved glass sphere in the muscle cone behind Tenon's capsule is the method of choice. If an implant is already present, additional correction can be obtained by placing another implant on the floor of the orbit; for this the author prefers acrylic resin. He believes that implants in the upper eyelid should be avoided.

Loss of the lower cul-de-sac can often be corrected by moving the conjunctiva downward into a pocket dissected down to the orbital rim. This can be combined with the operation for late implant, thus giving greater relaxation of the conjunctiva for the new fornix. If insufficient conjunctiva is present, mucous membrane from the lower lip is much prefered to the Thiersch graft.

For complete levator paralysis Leahey [40] prefers a modified Derby fascia lata sling operation by means of a strip of fascia from the thigh. In six patients preserved ox fascia gave satisfactory results but reaction was pronounced.

In patients having marked ptosis with complete levator paralysis and normal frontalis action, suspension of the lid to the frontalis muscle with a single 00 white nonabsorbable surgical (silk) suture is considered by the author to be simple and satisfactory, and the operation of choice. If the procedure is not effective or the appearance is not completely satisfactory, it is a simple matter to take the suture out later and put in another; or one of the more standard ptosis operations may be done.

When there is even very slight levator action, resection and advancement of the levator are preferred. A simple and very effective technique is outlined for resection of the levator by the external route.

The results in a series of 35 cases of blepharoptosis treated by anchoring the lid to the frontalis muscle by a single buried permanent suture are evaluated by Smith and Pang.[41] They prefer silk, cotton, or nylon as suture material. Favorable results are reported in 83% of the cases.

The technique for the operation is described. The postoperative complications are summarized as rupture of the suture following a heavy blow on the brow; postoperative trichiasis; limitation of motion of the eyelid and exposure keratitis resulting from an error in placement of the suture, and early and late infections around the suture.

Correction of blepharoptosis by shortening the levator muscle is preferable to operations that substitute use of the superior rectus or occipitofrontalis muscle for levator action. Indications for the Friedenwald-Guyton suture are given.

The problem of selecting the most efficient method for correction of ptosis among the numerous surgical ones devised is discussed by Sarwar.[42] The operation described was used on eight patients and ten eyes. It is based on the knowledge that reeducation of muscle is possible. A strip of the orbicularis is made to work as a false levator by attaching it to the tarsal plate. The orbicularis strip is dissected inward, and the muscle strip is brought down to the upper border of and through the tarsus and sutured to form the sling. A photograph of a satisfactory result is shown.

Converse and Smith [43] point out that the backward displacement of comminuted fragments of the nasal bones and the frontal process of the maxilla over the lacrimal and ethmoidal bones beyond the lacrimal sac causes fracture of the medial orbital wall. The medial canthal ligament is either severed

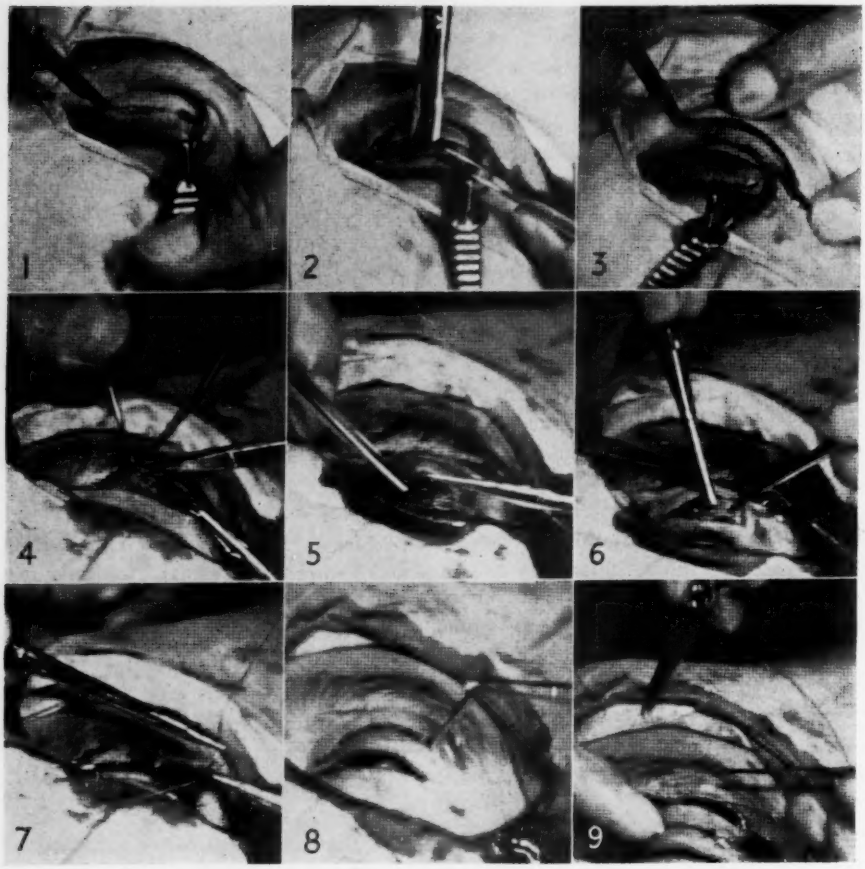


Fig. 2.—In this case the orbicularis strip was taken from the outer third of the muscle fibers as a variant. *1.* First incision. *2.* Dissection for exposing the upper border of the tarsus. *3.* Second incision. *4.* Orbicularis strip dissected inwards. *5.* Muscle strip brought down to the upper border of the tarsus. *6.* The strip through the tarsus. *7.* Suturing the strip to form the sling. *8.* Excess of skin being removed. *9.* Closure. (Reproduced by permission from Sarwar, M.: Brit. J. Plast. Surg. **4**:295, 1952, Williams & Wilkins Company.)

from its bony insertions or displaced laterally with the medial orbital wall.

In the authors' technique of combined canthoplasty and dacryocystorhinostomy, subperiosteal elevation of the medial orbital wall is begun by resection of protruding overlapping pieces of bone, and then location of the palpebral ligament and defining the limits of the sac. The nasal mucosa is incised, and the posterior flap of the nasal mucosa is sutured to the posterior flap of the sac. Through holes drilled in the medial orbital wall the medial palpebral ligament is anchored with Stainless Steel wire. The wire is twisted and cut. The dacryocystostomy procedure is completed. Three methods are shown for placing drill holes in the medial orbital wall for anchorage of the palpebral ligament: holes one above the other, holes one behind the other, and one large hole at the site of implantation of the medial palpebral ligament. A second channel joins the larger hole at a diagonal. The stump of the palpebral ligament is drawn up into the larger bony opening.

The technique is illustrated with diagrammatic drawings, and experience in the treatment of six cases is discussed, with case histories.

NOSE

The procedure as described by Peer and Walker [44] is adaptable for the correction of most types of oversized nasal deformity. An incision is made between the lower border of the lateral cartilage and the upper border of the alar cartilage and is carried downward along the top of the septum or in front of the septum. The lateral cartilages are detached from the septum and retracted laterally. The cartilaginous bridge of the nose is lowered by an incision through the septal cartilage and septal mucous membrane, beginning at the tip and extending upward to the bony bridge; the bony hump is removed by use of a wide osteotome, and the cartilage and bone are removed. Superior portions of the lateral cartilages are trimmed. Removal of the upper posterior part of the alar cartilages on each side will reduce any prominences. The bony bridge of the nose is fractured, and the nasal bone is separated from the septum on each side, followed by manipulation of the sides of the bony arch from the outside.

The authors conclude: The modern rhinoplasty for correction of the oversized nose is satisfactory to patients in about 94% of the cases. Secondary operations will benefit most of the dissatisfied patients. In their hands general anesthesia is preferable to local anesthesia. It is advantageous to combine the rhinoplasty with a submucous resection and trimming of the turbinates when the latter are necessary to provide good breathing space and adequate room for sinus drainage. Overcorrection of a deformity should always be avoided, since patients are not benefited by a radical change in their appearance. A good postoperative result is a reasonable degree of improvement in appearance and a normal-looking nose which does not appear as though it had been operated upon.

Safian [45] is concerned with the patient who, after an apparently good result, eventually develops a condition—a late change in contour of the nose operated on—which disappoints both the patient and the surgeon. The three important uncontrollable changes are (1) drooping of the nasal tip, (2) dorsal convexity, and (3) unequal retraction of the alar rims. In performing a secondary shortening of the nose, the tip should be advanced into a somewhat overcorrected position by the two septocolumellar sutures. A secondary operation for dorsal convexity consists of exposure of the nasal framework. The mass of fibrous tissue found on the dorsum of the septal cartilage is removed. Newly developed spongy tissue on the surface of the alar cartilages is trimmed. Safian corrects retraction of the alar rim by an incision just inside of it, undermines the skin for a short distance, and then implants a strip of preserved cartilage into the defect.

After employing most of the suggested techniques for shortening the long nose, Fomon and his colleagues [46] concluded that the only way to prevent postoperative dropping of the tip was to eliminate all stress or tension on the membranous septum. This is accomplished by the authors' procedure for shortening the nose by superimposition of the lower over the upper cartilaginous vault. Shortening the nose and modeling the tip must be done simultaneously by employing a sequence of steps: uncovering of the osseous and upper cartilaginous vault, uncovering of the lower cartilaginous vault, creation of a septolabial angle, suture of the mesial crura, shortening of the nose by superimposition of cartilages, reconstruction of the columellar inclination, modeling of the upper cartilaginous vault, shaping of the contour, and elevation of the terminal ends of the lateral crura. Since most of the cartilage is preserved, the possibility of a "pinched" appearance is obviated.

The article is excellently illustrated.

A technique is described by Gonzalez-Ulloa [47] to correct a wide nasal base, consisting of an incision made in the gingivolabial sulcus and undermining to the base of the nasolabial fold. Stainless Steel wire is inserted through the base of both the alae to narrow the width in the nose. The suture is left in situ and the incision approximated. This procedure has been used in more than 50 cases with satisfactory results.

Seltzer [48] outlines the various methods in submucous resections that have been devised for reconstruction when the columella is involved. Grafts have been secured from a variety of sources, both from the patient's own tissues and from preserved materials. The method used must be the one which most nearly meets the requirements of the existing conditions.

Vidaurre [49] uses semilunar cartilage of the knee joint obtained from the orthopedic department. He finds this type of homogenous graft very satisfactory. The semilunar cartilage is triangular, with the base of the triangle facing outward. This graft when incised along its base is put in place through a columellar or interbrow incision. It is a cartilage of little exigency and "takes" well. It is surrounded by perichondrium, which is another security, because it is not allowed to wrinkle and no burying or parboiling is necessary.

Fomon and his associates [50] now employ open reduction for practically all nasal fractures, limiting the closed method to simple fractures of the osseous vault. They summarize the advantages of open reduction. It permits an accurate diagnosis by inspection, precise reduction under direct vision, evacuation of effusions and better drainage, correction of preexisting defects, and attention to associated fractures. But for those who are unable to avail themselves of the operative method closed reduction is safer and more serviceable.

Salinger [51] points to the fact that the higher the state of development, the narrower is the pituitary angle, and the greater is the likelihood of a septal deviation. Another factor in the development of septal deformities is the occasional asymmetrical growth of the face. Trauma in early life also plays some part in the development of septal deformities. In developmental anomalies such as cleft lip and cleft palate the septum suffers marked degrees of distortion which not only affect the contour of the nose but also interfere markedly with normal nasal respiration.

The decision as to whether to restore normal nasal respiration by early operation on the septum or to wait until puberty or adult life is based, in Salinger's opinion, on the conditions existing in the individual. In general he agrees that the septum had better not be resected if it is at all possible to wait until the patient has attained his growth. Early closure of the lip defect should come first. He further agrees that as long as the premaxilla is still ununited to maxillary bones the septum had better be let alone.

Douglas [52] does not regard the nasal process operation as an adjunct to submucous resection of the septum. Among the indications for this type of treatment are submucous resection of the septum elsewhere without relief or with only partial relief, abnormally narrow nostrils from congenital causes, and congenital choanal atresia.

In the technique described a wedge-shaped portion of the margin of the free edge of the nasal process of the superior maxilla is removed through a curved or an "S"-shaped incision. After the osteotomy the surface of the bone is smoothed down and the mucoperiosteum closed over it without drainage. After removal of the stitches the nostril is kept dilated by daily passage of the largest rubber catheter that will pass easily into the nasopharynx.

Eight patients were treated by this procedure, with good relief of obstruction in all.

In a child with a congenital bilateral osseous choanal obstruction, Ersner [53] surgically restored patency and normal nasal respiratory physiology. The sinuses were fully developed and completely normal.

The inferior turbinates were infracted upward bilaterally; the mucous membrane of the bony portion of the obstruction was elevated, and the osseous obstruction was perforated with a dental bur. The criss-cross-incised mucous membrane was pushed backward to cover the raw exposed bony surface.

Postoperatively for the first time in her life the girl enjoyed smelling and tasting food. In Ersner's opinion this case demonstrates that the sense of smell is dependent upon air currents to carry odors to the olfactory nerve.

Steiss [54] believes that the lack of successful end-results of total and subtotal nasal reconstruction is due to lack or scarcity of ideal material for repair due to previous failure, radiodermatitis, very extensive defects demanding the use of neck, chest, or even abdominal skin replacement, and unknown antagonistic factors in the individual patient. A series of a failure and cases falling short of the hoped-for result demonstrate the factors involved in successful reconstruction.

CLEFT LIP AND CLEFT PALATE

In treating complete unilateral harelips, Le Mesurier,[55] of Toronto, Canada, limits the first operation to repairing the lip and nose only, and leaves the repairing of the whole palate and push-back for a later operation. If on the medial side of the cleft the lining of the vestibule is dissected free from the premaxilla and septum from below upward and its lower edge turned over into the shape of a circular tube, the inner margin of the nostril will follow it and assume much the same circular shape, and the lower edge of the lining can be made to form the inner half of the floor of the vestibule. This also brings the back end of the columella to the midline. Division of the part of the lining in front of the bone flush with the bone as it comes out of the pyriform opening allows the ala to be bent into something like a circle and allows the lining to be swung over from its vertical position to form the outer half of the floor of the vestibule. In addition, this lining of the vestibule tethers the upper margin of the nostril down and makes it flat, and its division along the pyriform margin, if it extends high enough, helps to allow the upper margin to assume its proper level and circular bend. The free cut edge of the lining tends to become folded into the lumen when the cleft is closed. In complete wide clefts fine bronze wire inserted in a fairly wide circle in and about the middle of the thickness of the lip crowds together the parts of the wound and obliterates any dead space.

Steffensen,[56] of Michigan, still favors the Le Mesurier procedure and has extended its use. His results with the "rectangular flap" method of repair of the single cleft lip continue to be consistently good. The application of the method for use in secondary operations in patients whose cleft lip is repaired by linear closure is uniformly satisfactory. Steffensen now uses the method in cases of a single complete cleft on one side and partial cleft on the opposite side, with results comparable to single cleft repairs.

Brauer [57] presents a plan for the Le Mesurier technique for single harelip repair which can be used routinely in all cases.

The vertical height on the side to be repaired is divided by the quadrilateral flap into two sections. Brauer prefers to cut the vermilion flaps in a sharp vertical manner just before the lower one-third of the lip is closed. The mucosa is closed in the same directions as the skin, which gives additional eversion to the lip.

In adapting this method to incomplete lips the quadrilateral flap is turned up into the cleft as far as possible so that the tip of the flap falls on the horizontal line. As the lip develops, this flap begins to rotate downward and medialward through an arch, and the tip of the flap becomes more and more distant from the horizontal line.

In secondary harelip repairs, a modified "Z" closure is made. In using this it is usually the rule to obtain a smooth, even curved vermilion with a nice pout. A Cupid's bow is rarely obtained. Brauer stresses the importance of not making the repaired side too long.

A slight modification of the Le Mesurier-Hagedorn technique for unilateral cleft lip has given consistently better results in the hands of Bauer and his colleagues [58] than those obtained by any other method. The lateral quadrangular flap is not brought completely to the midline; it is so designed that when rotated down into position its width will be about one-third of the total length of the lip. The transverse cut in the philtrum to create the triangular defect is not carried beyond the midline. A flap is rotated upward to aid in forming the floor of the nose. The mucous membrane of the lateral flap is cut

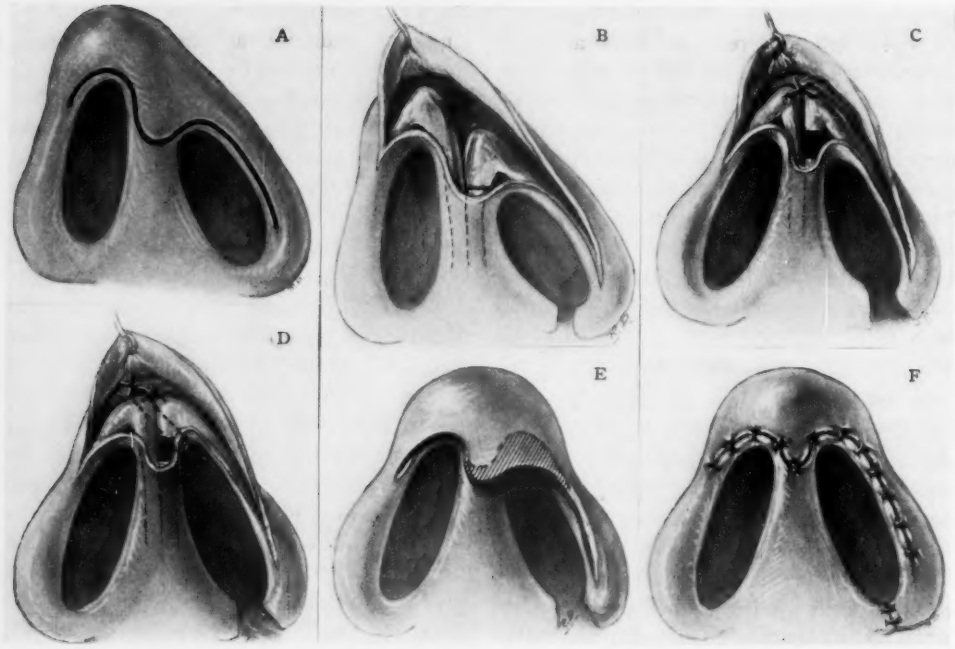


Fig. 3.—Technique of correcting a flattened nostril and deformed nasal tip due to an old, repaired, harelip defect. *A*, Incision. *B*, Skin elevated and retracted to expose alar cartilages. Medical crus cut across a few millimeters behind its junction with lateral crus. Segment of floor of left nostril excised to narrow nostril. *C*, Left alar cartilage elevated and sutured in a position symmetrical with the opposite side. *D*, Anterior end of deformed nostril elevated by passing a mattress suture of chromic gut from the normal alar cartilage to, and through, the skin at the anterior end of the vestibule of the deformed nostril. *E*, Shaded area shows excess skin to be removed after elevation of flattened nostril. *F*, Skin edges approximated with fine silk sutures. (Reproduced by permission from Erich, J. B.: Plast. & Reconstruct. Surg. **12**:*322*, 1953, Williams & Wilkins Company.)

in a concave fashion until it assumes normal thickness. This concavity then receives a convex flap from the medial side of the lip.

In the technique described by Tennison [59] to repair the unilateral cleft lip wire stencil is used in marking the incisions. The wire "Z" is then shifted to the columellar side and the upper end placed near the base of the columella. The upper angle is then adjusted so that the upper arm of the wire "Z" is parallel to the vermilion border and the middle arm of the wire "Z" is approximately perpendicular to the vermilion border. The skin incisions are deepened through the lip. Any necessary undermining of the face is done on the alar side, and the sides of the cleft are sutured together. The incision on the red border of the lip is also staggered by a flap shifted across in the opposite direction to the lower skin suture line.

Marcks, Trevaskis, and da Costa [60] consider the method of approach in Tennison's procedure for cleft palate and lip repair to be much more practical than other methods. It seems logical that an operation that preserves what appears to be a normal Cupid's bow formation should receive the utmost consideration.

A segment of thin wire is cut to fit along the mucocutaneous juncture to the point of union of the vermilion and the opposite philtral ridge. The wire is then bent into a Z of three equal arms. By joining points a nostril floor will be formed to match that of the opposite side.

The medial lip pattern is very similar to that of the Le Mesurier design except that

the upper arm is shorter. The authors decided that by first cutting the medial lip element, and opening the roughly horizontal incision until the proper lip length is attained, it is possible to estimate the size of the lateral lip flap necessary to fill the gap.

Erich [61] describes his technique for correcting a flattened nostril and deformed nasal tip due to an old repaired harelip defect. The skin along the free border of the nares is elevated and retracted to expose the alar cartilages. The medial crus is cut across a few millimeters behind its junction with the lateral crus. A segment of the floor of the left nostril is excised to narrow the nostril. The left alar cartilage is elevated and sutured in a position symmetrical with the opposite side. The anterior end of the deformed nostril is elevated by passing a chromic absorbable surgical (gut) mattress suture from the normal alar cartilage through the skin at the anterior end of the vestibule of the deformed nostril. When the elevated skin is returned to its original bed, there is some excess skin over the anterior end of the repositional nostril. It is important that this redundant tissue be trimmed away before the skin margin can be properly approximated with fine nonabsorbable surgical (silk) sutures.

Cannon and Murray [62] reemphasize the value of the split vermilion-bordered lip flap in the secondary correction of residual deformities following double harelip repair. The principle of the method is to discard the prolabium and replace it with a flap from the lower lip. By splitting the apex of the flap, a symmetrical correction of the upper lip can be obtained. The vermilion border of the flap and the upper lip can be accurately approximated at the first operation if the pedicle of the flap is properly prepared.

Ecker [63] holds that a full and equal lip can be obtained only by preserving the inferior mucosa and vermilion of the prolabium. A V-Y columella construction can be carried out, followed by a secondary repair of the lip and rhinoplastic procedures. The premaxilla can be stabilized when the vomer turnovers are done at approximately 1½ to 2 years of age, or they can be ignored and partially resected in the adult period. A skin-graft ridge of extension is useful in freeing an attached lip and allowing the seating of a denture with a labial flange.

Interrupted alloy steel sutures are employed by Large [64] for all layers in closure of cleft lip and palate deformities in the Mirault-Blair-Brown technique. The appearance of the scars is greatly improved, and the amount of tissue edema, induration, and infection seen with other suture materials is reduced.

The cleft lip and cleft palate are discussed by Ivy [65] as a total rehabilitation problem. He points out that the best thing possible is being done for these patients by cooperative effort in providing proper surgical, dental, and psychological treatment through the organization of group clinics.

As stated by Slaughter,[66] the surgical approach for ultimate closure of the lip or palate must be made so as not to disturb the biologically determined normal growth pattern. The general condition of the patient, the rate of weight gain, and other indicative signs of satisfactory well-being are the determining factors for carrying out the closure of unilateral harelip. In a modification of the Hagedorn procedure Slaughter places the notching nearer the mucocutaneous junction in order more closely to follow the normal configuration of the philtrum. No incision or undermining is carried beyond the midline. The attachment of the lower lateral or inferior alar cartilage is freed from the proximity of the maxilla to allow it to be rotated medially to aid in the formation of the floor of the nostril and reestablish a more normal nasolabial fold. These mobilized structures are moved into position and sutured in the desired relationship. The lip is closed over the defect in the bone so that it may act as a physiologic force to accomplish the desired change in contour. The guiding or directing of the growth potential accomplishes the desired end-result slowly and positively but does not interfere with growth factors of the involved structures.

In bilateral harelip the double cleft is converted into a simple cleft; then the single cleft is closed at a second operation. The flaps made in the philtrum proper are altered slightly in order to conserve as much of the tissue as possible.

Slaughter states that there is "no justification for the inferences that have been made recently, on the basis of purely cross sectional studies, namely, that cleft palate surgery is to be entirely avoided."

In a statistical study of 282 consecutive and unselected cases of cleft lip and palate, at the Straith Clinic, McEvitt [67] found that parental age has no bearing on the incidence of this deformity. For many years the presence of a similar deformity has been noted in parents or relatives of the patient. He believes that the abnormal genes which produce cleft lip and palate are a small percentage of the total number of genes. Under the laws of chance if a sufficient number of matings occur the cleft-palate gene will eventually manifest itself.

Following up Slaughter's idea, Dunn [68] uses a vomer flap to close the hard palate, a simple closure of the soft palate, and two small sliding flaps to close the remaining defect at the junction of the hard and soft palates. This technique produces a cleft closure without interfering with the development of the superior maxilla and gives a soft flexible soft palate. In the first two types the flaps are based above and swung to the edges of the palatal bones and maintained in position with mattress sutures. The edges of the palatal tissues are incised and not undermined more than 2 or 3 mm.

In the third type the operation is done in two stages, six months apart, first one side, then the other. A flap of sufficient length is made on one side with its base at the caudal edge of the vomer. The edges of the cleft are denuded, and the tissues are sutured in the midline as far forward as possible without undermining them. No lateral incisions are made. Two narrow flaps are employed to close the unclosed portion at the hard and soft palate junction.

The bilateral bone flap operation is used by Hyslop and Wynn [69] for correction of second degree, third degree, and bilateral cleft palates. The age at which they carry out the operation is between 9 months and 2 years for completion. They agree with Slaughter and Brodie that if a technique which is conducive to massive scar tissue formation across the palatal arch is used, this operation should be postponed until 5 or 6 years of age or perhaps longer, even though these children will develop bad speech habits which will require lengthy speech corrective teaching, and even though psychological problems are present. In review of their cases they found no malocclusion in the patients having cleft palates without harelips operated on at the age of 9 months or older.

The bilateral bone flap uranoplasty and staphylorrhaphy comprise the first operative step, and mucoperiosteal flap technique the second step, used only to close small openings in the anterior portion of the hard palate. This is the type of operation Peer performs.

The results from use of this technique do not interfere with growth of the palate bones.

Von Deilen [70] presents a case report of a patient who had had an original bilateral cleft of the lip and palate (hard and soft) which had been repaired elsewhere. In intensive secondary repair a Dorrance push-back operation was done in two stages, a fairly good velopharyngeal closure being obtained. The nose and upper lip were thus pushed out. The labial sulcus was deepened, and the base of the nose was freed and brought forward and all raw areas covered with a split skin graft. Then a modified straightening operation on the septum was done to improve the external nose. The two holes from the mouth into the nose in front of the premaxilla were closed by an appliance.

There is a dramatic change in the girl's appearance, and her personality has improved. Her speech is markedly improved; she will receive more speech training.

Olinger [71] points out how essential is a knowledge of embryology, anatomy, and physiology of the oropharyngeal structures and reviews the principles involved in cleft-palate prosthesis rehabilitation. Probably the most important function of an obturator and an artificial velum is to aid the speech. The technique for construction of an obturator includes an impression for a study cast made in either hydrocolloid or alginate in a stock tray, of a perforated impression tray of shellac baseplate material. The appliance is designed on the working cast, which may require correction. The baseplate and occlusion rim are constructed on the stone cast, and in the soft palate area a spade-like extension is made. The vomer is constructed after the cast has been corrected, and the artificial velum is formed.

After the soft palate has been repaired or restored mechanically, the patient must be taught to use the artificial velum by exercising the palatal muscles. Olinger concludes with the statement that the maximum success should be based on a long-range program in the hands of a reliable agency.

Dennis Browne believes that it is possible to set the premaxilla back in severe cases of bilateral cleft lip and palate and to free the soft tissue element of the premaxilla when it is set back, without interfering with growth. A nasolabial angle will result, which may be sufficient as the child grows to render secondary elevation of the nose tip unnecessary. The disasters which have brought the operation into disrepute, Browne further believes, are due to excising the anterior part of the vomer instead of the "prevomerine" bone. In his view the essential feature of a push-back operation is to keep the septal excision in front of the suture line between the vomer and the "provomerine" bone.

Matthews [72] uses Browne's method for removing the prevomerine bone in the form of a wedge, and repairs the lip and closes the alveolar clefts according to Veau's procedure. The retropositional premaxilla is stabilized by a two-pronged pin of the author's design. Occlusion was satisfactory in 17 of 20 patients on whom this procedure was performed. Secondary elevation of the nasal tip was performed in seven patients.

Coe [73] was dissatisfied with the results from the use of Beau's complicated method for closure of the opening posterior to the premaxilla in repair of bilateral cleft palate. About 10 years ago he began to employ a flap from the posterior surface of the premaxilla in a manner that was different from any found in the literature. If the usual lateral mucoperiosteal flaps do not permit satisfactory closure of the anterior end of the cleft, a flap larger than the defect is laid out on the posterior surface of the premaxilla with its base at the nasal septum. The flap, which has an excellent blood supply, is reversed with its mucous surface toward the nasal cavity and is held beneath the ends of the lateral flaps with suitable stitches. The edges of the lateral flaps are then united over the raw surface of the premaxillary flap.

Adams and Adams [74] do not approve of any type of section of the vomer, for it is likely to lead to arrested development of the premaxilla. They now prefer to employ a procedure in which the prolabium is utilized to form the entire central portion of the lip, with only minimal undermining and rearrangement of the columella and alar cartilage. They are convinced that the prolabium should be used in its entirety in reconstruction of the cleft lip.

MOUTH

Schultz [75] briefly describes and discusses the etiologic factors producing burns—thermal, chemical, radiation, and electrical—in the mouth.

Chemical burns from acids or alkalies should be neutralized and given cautious and thorough lavage. Radiation burns from roentgen rays or radium are treated best with watchful expectancy and supportive treatment, allowing them to heal before attempting a plastic repair. Electrical burns, common in babies, may produce many changes, ranging from a mild hyperemia to a black char.

The most important factors in the treatment of burns of the mouth are control of

pain, prevention of shock, reduction of infection to a minimum, active treatment of the denuded area to promote growth of granulation tissue, and plastic repair of skin, muscle, and mucous membrane at the proper time.

In a mild burn, a pentobarbital (Nembutal) calcium suppository of 1/2 to 1 grain in a baby may be adequate to control pain, or one acetylsalicylic acid tablet may be sufficient for a child, or ¼ grain of morphine for an adult. In extensive burns three to four times this dosage will not be dangerous and may help substantially in preventing shock.

Where skin, muscle, and mucous membrane have been destroyed, particularly in the upper or lower lip or both, it is recommended to allow these parts to heal before a plastic repair is attempted. Burns which destroy the vestibule of the upper or lower jaw and cheek, in more cooperative patients, can sometimes be corrected immediately by placing a split skin graft over a stent of modeling compound or acrylic and joining it in place.

The typical electrical burn in babies destroys the corner of the mouth. Frequently in the reconstruction, and by proper preparation of flaps and suturing, a good cosmetic result can be obtained. Often when one-half or more of the upper and lower lips has been destroyed, the oral cavity becomes almost completely occluded. Many horizontal incisions in the cheeks balance the opening. Elevation of skin and mucous-membrane surfaces and approximating them will effect a good correction. Discrepancies in the lip tissues, where tissue is lost or where there is too much tissue, causing an irregularity in the vermilion border or in the mucocutaneous junction, can be corrected by the typical V-Y plasty. Destruction of large masses of tissue can be corrected by only one method; the pedicle tube. The author recommends massage of burned tissues.

Abrahamson [76] reports an unusual case of congenital defects consisting of (1) an elongated snout-like process, measuring 3 by 1 by 0.08 cm., (2) a fusion of the anterior end of the inferior surface of the tongue with the inferior gingival border, and (3) bilateral cleft in the lower lip. This cleft extended through three-fourths of the width of the lower lip and had a knob-like mass of tissue, 3 by 2 by 1.5 cm., between the two clefts. Radiographically, there was separation of the mandibular bones in the midline.

It is thought that the case represented a parasitic monster (epipalatus) of the hard palate, and, additionally, ankyloglossia, or fusion of the tongue with the lower gingival border, and bilateral clefts of the lower lip. The author believes that a theory indicated by the studies of Pohlmann (1910) and Veau (1938) explains bilateral clefts in the lower lip on a developmental basis. Actually an ectodermal "hood" develops over the front of the oral cavity adjacent to the primitive nostrils. These ectodermal tissues are invaded by mesoderm from the edges of the oral cavity. In the absence of mesodermal supporting tissue, the ectodermal tissue ruptures and a cleft is formed.

Preoperative and postoperative photographs of the infant show the results of surgical correction. There are also tissue photomicrographs.

A case of congenital fistulae of the lower lip was described in 1845, and the literature on the subject was reviewed in 1938. The etiology of the condition being obscure, an investigation was undertaken by Warbrick, McIntyre, and Ferguson [77] to throw light on the problem by study of human embryos of various sizes.

It seems probable that the origin of the lesions is in some way related to the presence of the lateral sulci on the normally developing mandibular arch. The study suggests the failure of obliteration of the cephalic end of the lateral sulcus, which produces a furrow. This becomes deeper as growth proceeds, ultimately becoming a tubular canal which is incorporated in the substance of the lower lip as the latter separates from the main mass of the mandibular arch. The incorporated canal would remain as a congenital fistula.

THROAT

From a series of 115 cases of cancer of the cervical esophagus Watson and Con-

verse[78] report on 19 proved cases in all of which the patients were treated by excisional surgery and survived long enough to permit reconstruction of the esophagus. As a general rule, on completion of the initial operation, the patient is left with a pharyngostoma, a tracheostoma, and an esophagostoma.

The authors discuss the stages in the development of their present plan of treatment. They decided that an adequate cancer operation requires the inclusion of the en-bloc removal of the cervical esophagus and larynx.

The plastic reconstruction in most of the patients treated by this procedure was accomplished by utilizing two lateral, rectangular flaps of skin, subcutaneous tissue, and platysma. An alternate procedure for the formation of a cervical esophagus consists of migrating a tubed pedicle graft from a hairless portion of the anterior chest wall, in steps, up to a point well above the pharyngostome.

Watson and Converse consider postoperative complications, such as local cellulitis, laryngeal edema, the possibility of parathyroid deficiency and myxedema, salivary fistulae, and stricture. In only two patients was it necessary to reopen the new esophagus months after it had been successfully reconstructed.

In four patients they were able to bring the stomach up into the neck and anastomose it to the cervical esophagus after removal of a cancer in the first portion of the esophagus. There are three case reports with illustrations.

In the opinion of Negus,[79] of King's College Hospital, London, for carcinoma at or near the mouth of the esophagus, involving the posterior surface of the larynx, only radical removal of a segment of the pharynx and upper end of the esophagus, together with the whole of the larynx, appears adequate. Two principles were adopted by the author: (1) removal of the growth as soon as possible and (2) complete removal, in one stage, and in one block, of glands, fascia, and lymphatics, combined with removal of the larynx and the affected portion of the pharynx and esophagus.

To reestablish continuity of the esophagus a self-retaining plastic tube was introduced into the cut ends of the pharynx and esophagus and encircled with a split skin graft. Immediate provision is made for the passage of saliva. In about two weeks the temporary nasal feeding tube passed through the plastic tube is removed and thereafter swallowing is possible by the natural route. The plastic tube was originally allowed to remain for six months, but the right period is probably two months.

The general opinion of the patients, as stated by Negus, is that the method of treatment adopted is not a severe ordeal.

This article by Moore and Faulkner,[80] of King's College Hospital, London, is concerned with the problem of repair of the esophagus and pharynx following pharyngolaryngectomy.

The repair of the esophagus and pharynx must be carried out in the shortest possible time. The multiple-stage repair loses point if recurrences occur while the reparative operations gradually take shape over many weeks. The authors describe the method introduced by Negus, in which repair is done at the same operation as removal of the larynx and part of the esophagus and pharynx. The disadvantages are mainly technical and will be overcome when a suitable indwelling tube is designed for use during the contractile stage of the graft. Stricture formation is a complication of the Negus method and multiple-stage repairs.

Repair of strictures by transposed flaps, by external local flaps, by the Wookey method of large Trotter or transverse flap, and by lateral flaps is discussed.

In the procedure of two-stage reconstruction devised by Moore and Faulkner, the pharyngoesophagolaryngectomy is performed through a slightly lateral I-shaped incision or a modification of this incision. In the first stage the two limbs of the "I" incision are sutured together in the midline but staggered so that a dart of skin is inset into the esophagus and pharynx.

In the second stage of the operation a prolongation on one inturned flap may be

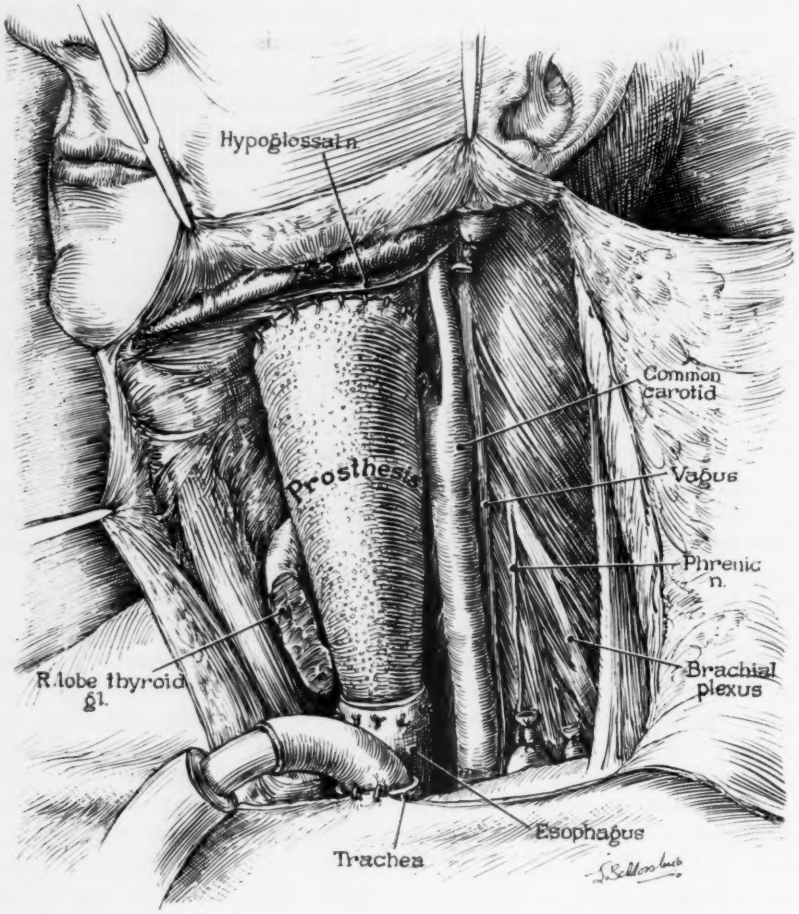


Fig. 4.—The prosthesis is now in position and it may be seen how the vascular nature of all the surrounding structures of the neck serve as a bed for the new graft. The prosthesis is fitted within the esophagus at the lower end to avoid possible fistula formation. (Reproduced by permission from Edgerton, M. T.: Surgery **31**:246, 1952, C. V. Mosby Company.)

used to reconstruct the ventral wall of the esophagus in the defect and a prolongation in the ascending flap to repair the defect in the trachea. The ascending and descending flaps are sutured into position, and the cross-hatched areas are closed with split skin grafts.

Recurrences of strictures are not uncommon during a protracted repair, and for this reason quick methods are used.

The causes of subglottic stenosis are classified by Conley [81] under the following headings: congenital origin, infections, new growth (malignant growths of the trachea or associated structures and benign neoplasms), and trauma.

Six therapeutic methods are classified: dilatation, free graft only, free graft and stent, direct approximation, utilization of mucoperichondrial flap, and reconstruction of the trachea—and each method is illustrated by presentation of a case, with diagrams and photographs.

As stated by Edgerton,[82] any operative intervention for cancer of the oral cavity, pharynx, hypopharynx, or cervical esophagus requires early reconstruction of the cervical esophagus and pharynx. To the author it

seems important to replace large defects in the surface of epithelial tubes within the body by epithelial grafts, as in similar defects on the outside body surface. Free split-thickness skin grafts have been applied by Edgerton by fastening them to the external surface of a metallic mesh. The mesh in such cases serves primarily as an elastic mold or stent, and may actually be removed later if desired. Such skin grafts come to simulate rather closely the normal lining of the pharynx and upper esophagus, apparently undergoing some metaplasia with a decrease in the amount of keratin.

Four cases in which such reconstructions were carried out are presented. These patients without pharyngeal muscle are able to swallow a regular diet and also develop an acceptable esophageal voice. This technique was attempted on two patients to reconstruct tracheal defects.

Wynn-Williams [83] reports on two cases of congenital midline cervical cleft and web which showed unusual features. In the first patient the cleft midline in the anterior cervical region had been present since birth. The cleft was excised by an elliptical incision at the normal skin margin. Repair of the vertical deficiency was effected by a large Z-plasty.

In the second patient, with a midline web and a "tag of skin below the lower jaw," the cleft and projecting tag of skin were excised together with the fibrous band as far as the suprasternal notch. A double Z-plasty was performed.

The possibility of a delayed fusion of the elements of the mandibular arch with failure of a normal ectodermal development is suggested.

JAW

As stated by Erich,[84] in edentulous patients "with bilateral fracture of the mandible, the enthusiasm with which some of us embraced the use of pin fixation a few years ago is conspicuously absent today. . . ." He no longer employs pin appliances for this type of injury. If the upper and lower dentures are available for use, the fragments are forced into proper position by manipulation, while immobilization is effected by means of the lower denture acting as a splint. It is attached to three lower fragments of the mandible by circumferential wires which are passed around the bony segments and over the denture. Erich uses a plaster head cap to which wires can be attached for holding the patient's upper denture when the fragments are situated in or distal to the first molar region.

A study of 434 mandibular fractures at The Johns Hopkins Hospital is presented by Edgerton and Hill.[85] Stout wiring or arch bars with elastic traction were employed in all patients in whom dentition was adequate. Open reduction and Kirschner wire fixation have become more satisfactory, giving rise to surprisingly few complications. Circumferential wiring, head caps, and elaborate dental splints are used less often. External skeletal fixation by modified apparatus was utilized in cases where fixation by open reduction was feared, but complications were numerous.

Some surgeons still prefer the use of fixation by pins in jaw fractures. Gerrie [86] employs double-pin fixation in maxillofacial injuries, at the Montreal General Hospital, and finds the method useful in about 10% of such fractures. McDowell and Brown [87] have obtained firm union in difficult situations by this method, secondary operations and bone grafting hardly being required at all. Stephenson and Graham [88] present cases to illustrate the usefulness of the Kirschner pin in maintaining a condylar fracture. Early motion is allowed and trismus avoided.

A series of 180 cases of fracture of the mandibular condylar process has been examined by MacLennan [89] in an attempt to formulate some opinion regarding lines of fracture. Most fractures of the mandibular condyle involve the neck and run downward and backward from the sigmoid notch (low condylar fractures). Children below the age of 5 years would appear to be more prone to permanent growth changes following fracture of the condylar process. Such damage to the condylar growth center is found to

diminish in direct ratio to the age of the patient over 5 years.

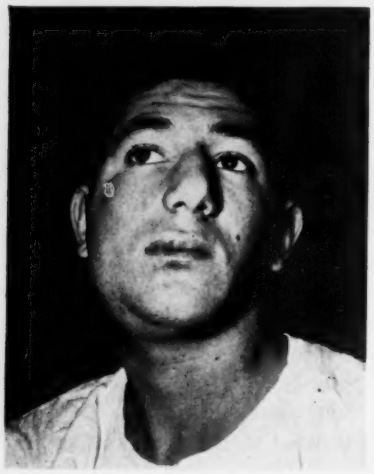
Conflicting opinions persist with regard to corrective surgical methods employed in developmental malformations of the jaws. Deformities may affect one or more portions of the jaw. Converse and Shapiro [90] classify jaw malformations of the maxilla, which are often associated with malocclusion and may involve other parts of the facial skeleton. Diagnosis depends largely upon standards of comparison, these being conditioned by racial, environmental, and cultural considerations. Photographs, casts of the dentition, and cephalograms for facial measurements are studied in order to arrive at correct diagnosis.

The authors review the anatomy of the heavy muscles of mastication which play an important role in the displacement of surgically separated parts of the mandible. The anticipation of muscular action on the separated parts is of prime importance previous to surgery.

The principles of the surgical treatment of developmental malformations of the jaws are reestablishment of upper and lower jaw relationships to achieve the best possible dental occlusion, the restoration of contour with bone grafts or prostheses, and the resection of hypertrophic bone.

A number of surgical techniques for the treatment of mandibular malformations with malocclusion of the teeth are described: section of the ramus of the mandible; an operation for intraoral single-stage osteotomy of the body of the mandible, with preservation of the inferior alveolar neurovascular bundle; transplantation of the inferior alveolar nerve and its branches, and step osteotomy to elongate, shorten, and shift segments of the body of the mandible. The choice of appliances to assure fixation of parts following osteotomy is discussed.

The treament of mandibular malformations without malocclusion, including contour restoration by bone grafting and resection of hypertrophic bone, is reviewed.



A

B

C

Fig. 5.—*A*, preoperative view taken on Feb. 3, 1951. *B*, roentgenogram preoperative view taken on 2-5-51 showing fracture of the condyloid process, medial and anterior displacement and fracture in the vicinity of the second molar. *C*, Kirschner pins in place (Feb. 16, 1951). (Reproduced by permission from Stephenson, K. L., and Graham, W. C.: Plast. & Reconstruct. Surg. **10**:20, 1952, Williams & Wilkins Company.)

Maxillary malformations with and without malocclusion of the teeth are discussed, and a technique for the surgical advancement of the maxilla is given.

Typical examples are illustrated, and four selected case histories are described.

In a case of congenital absence of the ramus on the left side, reported by Harris,[91] a boy, about 2 years of age, had a few ear remnants just anterior to the tragus and the usual asymmetry and marked atrophy on the affected side. A homogenous cartilage transplant was inserted through a vertical incision just anterior to the left ear. A canal was tunneled from the region of the angle of the mandible to the mandibular fossa. Fifteen months later some of the cartilage was moved and a homogenous bone graft was inserted into this tunnel, extending toward the mandibular fossa. To date there is marked improvement. When the boy is about 12 years of age an autogenous bone transplant will be inserted to form a permanent ramus. The same procedure was carried out in the second case, homogenous rib again being used.

In the surgical technique described by Braithwaite and Hopper,[92] an incision is made below and behind the angle of the mandible and the masseter muscle is elevated upward to the sigmoid notch. The mandible is then divided in the estimated occlusal plane, and the bone gap is increased. Ox cartilage inserts, shaped to fit the cross section of the ramus, are placed between the bone ends. After the mouth has been kept open by a "dental prop" for 10 to 14 days, it is replaced with an exerciser. Active reeducation of the muscles of mastication is necessary during the first few weeks following surgery.

Before the year 1851 ankylosis of the temporomandibular joint must have occurred more frequently than today. Adequate trauma to the jaw was produced in hand-to-hand combat, and infections of the mouth, face, and ears progressed with more devastating effect than today. Lewis[93] further relates that in 1851 Esmarche described what is essentially the modern concept of treatment.

Lewis has obtained satisfactory results from osteotomy of the mandibular ramus just below the temporomandibular joint. A skin flap includes the superficial fascia dissected from in front of the ear lobe to the tragus and anteriorly along the zygoma; then the deeper layer of fascia is incised down to the temporal artery. The joint and condyle are exposed by freeing the attachment of the masseter muscle posteriorly from the zygoma, and a section of the mandibular ramus is resected with a Gigli saw and a rongeur. After three or four months indicated secondary deformities are corrected by preserved cartilage implants to the chin or a bone graft.

Longacre and Gilby[94] employ autogenous cartilage implants in arthroplasty of the temporomandibular joint in many conditions.

They compare the results of arthroplasty with fascia with those with cartilage implants. With the use of cartilage implants in bilateral cases function has remained excellent and there has been no tendency to develop open bite or retrusion. Utilization of the upper approach has shown no tendency of the cartilage implant to shift. In a follow-up of unilateral cases showing excellent function there has been a slight shift toward the opposite side. This tendency, the authors feel, may be avoided by anchoring the cartilage graft securely with fascia lata to the upper fragment of the ascending ramus. The interposition of the cartilage is thought to allow the residual condylar neck or ascending ramus to act as the fulcrum and so retain the function of the mandible as a lever of the third class.

The destructive nature of bilateral condylectomy is illustrated by Smith and Robinson.[95] In a case of fracture of the mandible followed by disability subsequent to bilateral condylectomy one and a half years previously elsewhere, the displaced mandible was fixed with intermaxillary wires and the condyles were reconstructed with iliac bone grafts and nonelectrolytic metal onlay, giving an excellent result. In a second case of successful bilateral condylectomy, done 16 years previously, the mandible had retruded and

open bite exists, for which the new procedure will be employed.

Christie [96] presents three cases of internal derangements of the temporomandibular joints causing clicking, snapping, and locking. He opens the joint by capsular incision, and depresses the condyle to gain access to the joint cavity. The disc is located in the forward compartment and dissected free from the capsule. The effect of the operation is to remove the obstructing cartilage and incidentally tighten the loose capsule by scarring.

In Gonzalez-Ulloa's technique [97] for correcting prognathism the most important step is to predetermine the precise amount of condyle to be removed in order that the necessary correction be accomplished within narrow limits. He uses the skenographic method for this purpose, which is described. A study is made of the relation the teeth will have in a plaster model of both dental arches.

A curved incision is made beginning at the head of the condyle in front of the superficial temporal artery and behind the small branches of the facial nerve. Downward traction of the wound is exerted with a strong retractor, while two other retractors are placed on each side of the condyle.

In a new surgical procedure by Smith and Robinson [98] for the correction of the retruded mandible, an L-step submandibular-notch sliding osteotomy is performed. Success with this procedure will depend on an accurate preoperative determination and extent of the osteotomy. A study is made of roentgenograms plus cephalometric measurements, photographs, a face mask, plaster models of the dental arches, and intraoral Gothic arch tracing.

Von Deilen [99] believes that immedate covering of raw surfaces alone will prevent about 50% of the deformities seen today. If contracture and distortion of the remaining tissues are prevented, the task of reconstruction is accomplished by adding the missing parts. In restoration after resection of one or both superior maxillae, the entire raw cavity, including undersurface of the orbital contents, is covered by a split-thickness skin graft held in place by a suitable stent.

Adequate irradiation precedes a radical resection of the lower lip, the anterior mandible, the floor of the mouth, and the anterior portion of the tongue. Von Deilen usually cleans out the suprahyoid region bilaterally in resection. A double-ended curved tube fashioned in the chest, with its raw area covered with a split skin graft, is used for repair.

After resection of half of the mandible with portions of one cheek, the floor of the mouth, and the lateral tongue, restoration is carried out with an upper neck flap fashioned at the beginning of the radical neck dissection to resurface the raw areas. The functional and cosmetic results are good. Any oral fistula is easily closed.

As stated by Kazanjian,[100] the purpose of transplanting bone to the mandible is to reestablish the continuity and function of the mandible and to restore facial contour. The facial restoration is effected by employing bone as a filling material where is has been lost or has not developed. Osteomyelitis, less frequently encountered due to use of antibiotics, and neoplastic disease are the chief causes of loss of mandibular bone. Many facial deformities are the result of malposition or maladjustment of the mandible, arising additionally from malunion of fractures, developmental abnormalities from childhood diseases of the bone, and congenital defects, such as agnathia or lack of development of the symphysis. Soft-tissue abnormality causing loss of normal contour may require bone transplantation.

Bone grafts should be transplanted into healthy tissue. The indications for use of the block of bone graft, and osteoperiosteal and chip graft are given. The use of retaining devices is recommended for controlling the remaining separated parts of the mandible. Malposition is corrected by the proper means of fixation. The procedure of choice for restoring continuity of bone structure is determined by the amount of bone missing. For restoring contour bone from the iliac crest is preferred, by the author, to cartilage or

inert material. Proximity of living bone is a factor in the use of bone graft for contour restoration.

Kazanjian describes and diagrammatically illustrates his method of restoration by removal of bone from the iliac crest, fixation of the shaped bone graft by cutaneous sutures after exposing the anterior surface of the symphysis, and the addition of pieces of bone under the main transplant to accentuate the prominence of the chin.

BENIGN AND MALIGNANT GROWTHS

Angiomas.—These lesions are classified by Havens and Lockhart [101] into (1) hemangiomas, or tumors of blood vessels, and (2) lymphangiomas. The majority of angiomas, which occur about the head and neck, involve only skin and subcutaneous structure, but some involve both skin and mucous membrane.

The authors give a pathological description of capillary hemangiomas (port-wine stain, strawberry birthmark, nevus araneus, and senile angioma) and cavernous hemangiomas.

Lymphangiomas are divided into simple lymphangiomas, cavernous lymphangiomas, and cystic hygroma, considered by many to be a cystic form of lymphangioma.

Treatment is usually complete removal of the lesion by excision or by electrocoagulation. Excision may be followed by either primary suture of the wound or application of a skin graft. Electrocoagulation is used only to remove small lesions. The lesions may be obliterated by means of injections of sclerosing solutions or of boiling water, ligation (either alone or in combination with injections), deep electrocoagulation and irradiation with roentgen rays or with radium applied to the surface or interstitially, and refrigeration by application of carbon dioxide snow.

Interstitial irradiation is valuable in the treatment of cavernous hemangiomas. Radon seeds (of 0.1 to 0.4 mc.) are implanted throughout the lesion so that a radon seed is present in each cubic centimeter of the tumor. The authors believe that the possibility of malignant change in its irradiated tissue is remote or nonexistent.

Roentgenotherapy or surface application of radium is the treatment of choice except for situations in which excision or partial excision may be necessary. External irradiation alone often is sufficient for cystic hygroma.

Treatment of port-wine stains by any means other than excision, which is usually followed by grafting skin, is likely to prove disappointing because of the difference in color of the grafted skin and that of adjacent normal skin.

Hendrick [102] has confined his article to the subject of angiomas occurring as developmental anomalies. They include hemangiomas (capillary, venous, and cavernous varieties) and lymphangiomas. The location, relationship to other tissues, the manner of growth of these types of tumors, and the pathological changes some undergo are discussed in detail. Hemangiomas are common tumors of the head and neck in infants and children; lymphangiomas are more likely than hemangiomas to assume distinct neoplastic properties, and are more difficult to eradicate.

Either radium or roentgen-ray therapy has been valuable in the treatment of hemangiomas of the skin. If cystic hygromas are permitted to persist, there may be rapid growth, with embarrassment of surrounding structures in the neck, mouth, and chest. They can be safely treated with aspiration of the cyst contents and immediate injection of sclerosing solution, followed in three to six weeks by complete surgical excision.

As expressed by Barrett Brown and Fryer,[103] to control an arterial hemangioma without injury to or disturbance of the growth of the surrounding parts, with the least possible scarring, is the aim of treatment, and the decision regarding the best way to accomplish it is made for each individual tumor.

Interstitial irradiation in minimal dosage is often indicated for treating arterial he-

mangiomas. The authors give examples of cases of such lesions in the facial region which were controlled by application of a light dosage of 0.1 mc. gold radon seed per cubic centimeter of tissue, with excellent results. The low dose has not been reported previously as far as can be determined, and is advocated to supplant other suggested dosages of 0.25 to 0.5 mc.

This 0.1-mc. dosage of gold radon seeds is most often used, controlling about 1 cc. of arterial hemangioma with the least chance of irradiating the surrounding normal tissue.

In an instance of radiation of a large growth there will be permanent change in the area that will probably require plastic surgical repair later.

For intractable growths, heavy radiation therapy may be used to control the growths, and then the skin of the area may be resected and replaced with free skin grafts to prevent the chronic radiation changes that are known to occur. For the intractable cavernous type a trial of multiple chromic absorbable surgical (gut) sutures is suggested, as in the face. Late repairs of defects from slough, surgical removal, and radiation lesions following treatment, and primary replacement of stained areas with free skin grafts and pedicled flaps are illustrated.

Matthews,[104] of London, believes that a more scientific approach than the policy of laissez faire in the treatment of hemangiomas in childhood is to try to determine which clinical types have a high incidence of spontaneous regression and which persist and grow. He holds that birthmarks, congenital malformation, differ from benign tumors in several important respects. They are present at birth, do not possess a capsule, and often have the power of limitless growth, both by canalization and by the multifocal budding of new cells.

In addition to the methods of treatment given by Havens and Lockhart, Matthews considers among procedures to produce sclerosis cautery and diathermy, radioactive paints (thorium X) as well as surface radium, roentgen rays and interstitial gamma radiation, saturated saline, Ethamolin Froth, and a combination of sclerosis and surgery.

A satisfactory method for spider nevus is to pierce the core with a diathermy needle and then to turn on the current for a few seconds. No treatment is needed for neonatal staining. Superficial capillary hemangiomas require several treatments of diathermy, improvement slowly occurring in the majority of patients. For port-wine stains in childhood diathermy coagulation or beta radiation should be tried. If the use of a cover cream is unacceptable, surgical excision and replacement with free grafts are the alternatives. The author believes that the injection of saturated saline into a strawberry mark of sufficient depth perhaps produces the most satisfactory results. Use of this procedure may often resolve a cavernous hemangioma, followed by the subsequent removal of any thickening left by the fibrosis. Giant rapidly growing cavernous lesions should be treated by surgical removal of the mass, while sclerotic agents are employed to check the rate of growth of such lesions. An arterial hemangioma should be excised. Early high ligature of the main artery supplying the limb is the only way to save the life of a child who has diffuse hemangiomatous giantism.

Dermoid Cyst.—Crawford and Webster [105] reviewed the American and British literature on dermoid cysts of the nose covering the last 50 years, which revealed a total of 51 cases reported prior to the group presented by them.

It is quite generally agreed that dermoid cysts of the nasal structures result from variations in the normal development of the individual in early intrauterine life.

The authors made a brief statistical study of all surgical specimens in the Columbia-Presbyterian Medical Center, New York, diagnosed histologically as dermoid tumors. In a series of 14 cases of dermoid cysts of the nose proved by histological study, operation had been carried out. In 11 of the patients the lesions occurred in the midline, while in 3 they were present between the inner canthus and the nasion. They are most

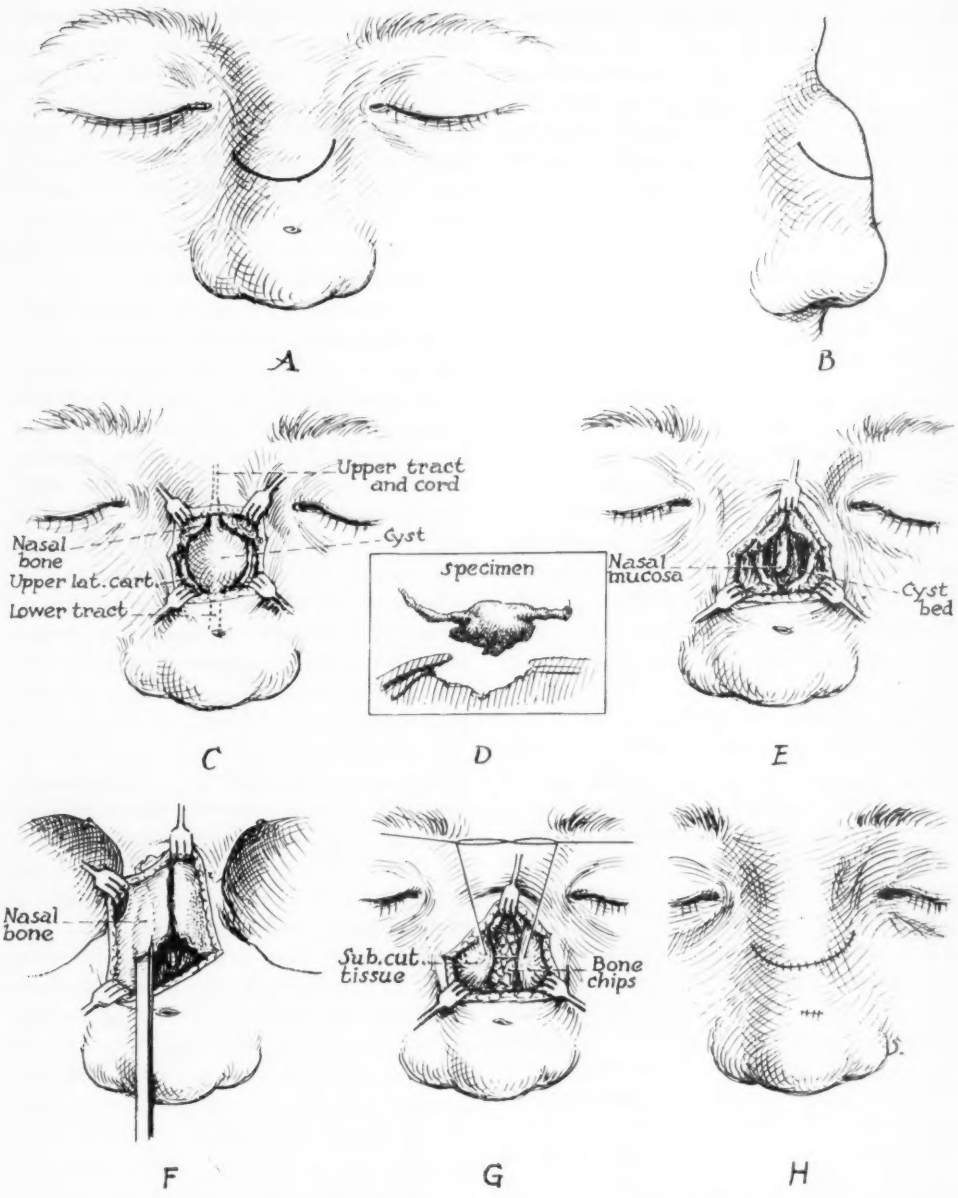


Fig. 6.—(*A-B*) The lines of incision to expose the cyst and excise the skin orifice of the sinus tract are shown. (*C*) The cyst is shown in the cup-like deformity it has produced in the nasal framework with the sinus tracts extending above and below. (*D*) The dermoid cyst and its tracts are shown intact as removed. Sagittal view of nasal deformity; (*E*) The lesion has been completely removed and the defect is shown from the front. (*F*) The flared portions of the nasal bones are being removed with the osteotome. (*G*) The chips from the nasal bones are used to fill the crater formed by the cyst. The chips are immobilized by suture of the subcutaneous tissue over the area. (*H*) The skin wounds are closed. (Reproduced by permission from Crawford, J. K., and Webster, J. P.: Plast. & Reconstruct. Surg. **9**:251, 1952, Williams & Wilkins Company.)

frequently discovered in infancy or youth, but may not become evident until later in life. While they are usually subcutaneous, there may be tracts leading from skin into or under bone. Almost invariably sebaceous glands are detected microscopically in the cyst wall, and less frequently hairs, sweat glands, and even lymphoid tissue may be present.

Lack of familiarity with this particular entity was shown repeatedly by the inaccuracy of the diagnosis made at one time or another in many of these cases. The treatment given to several of these patients prior to complete excision of the cystic tumor gives further evidence that the pathology and embryology are not generally understood.

As stated by Champion and Prendiville,[106] of Manchester, England, the first indication of a dermoid cyst of the nose is usually a dimple, which may become cystic beneath. Broadening of the nasal bones, discharge, and cellulitis of the nose lead the patient to seek advice.

Roentgenograms may show a bifid nasal septum. After complete excision of the cystic tract, secondary plastic procedures may be necessary to correct the remaining defect.

In a case reported by Erich and Johnsen,[107] a large tumor, measuring 15 in. in circumference, in a child 15 months of age, was removed along with a small portion of buccal mucous membrane of the cheek, which was adherent. The cyst was reported to contain teeth, bone, hemorrhagic material, sebaceous material, hair, and fat. This tumor had been present at birth and appeared to be related to faulty closure of the intermaxillary cleft.

Nasal Cyst. — Macomber and Wang[108] roughly classify congenital neoplasms of the nose according to their embryonic origin into three groups: tumors of neurogenic origin (the gliomas, the encephaloceles, and the neurofibromas), tumors of ectodermic origin (the dermoid cyst or the pilonidal sinus), and those of mesodermic origin (the hemangiomas).

The neurogenic tumors are formed as a result of persistent patency of the dural process in the prenasal space during development, with consequent herniation of brain tissue.

A glioma of the nose may be of the extranasal or intranasal type, both benign in nature. An encephalocele is a herniation of the brain tissue into the nose. There is always a skull defect. The mass either pulsates or increases in size on straining. A neurofibroma of the nose is a local manifestation of generalized neurofibromatosis.

The ectodermic tumors result from a failure of the dural process to separate from the true skin, which is then carried into the prenasal space. Since the dermoid cyst and pilonidal sinus share an identical anatomical structure and epithelial origin, and present a similar clinical picture, they can be safely considered one disease entity at different foci.

A simple cavernous hemangioma may occasionally be mistaken for a neurofibroma or an encephalocele. A fibrotic cavernous hemangioma presents the most difficult problem in differential diagnosis from other congenital neoplasms of the nose.

Klestadt[109] reintroduces a theory regarding the origin of nasal cysts according to which the subalar cyst could be compared to the branchial cleft cysts. Certain arguments are offered to support this suggested facial cleft cyst theory. The area where the subalar cyst is found is identical with that of the fusion of the three embryonic facial processes. The epithelial lining of the cyst shows the character of genuine nasal epithelium. Analogy with the branchial cleft cysts is apparent. Symmetrical occurrence is not infrequent and is better explained by developmental disturbance than by retention. There is evidence of a hereditary factor.

Thyroglossal Cyst.—Figi and Johnson[110] report two cases in which a cyst of the thyroglossal duct was encountered in the course of an operation that was primarily for an epithelioma of the larynx. In neither patient was there evidence of a recurrence of either lesion.

The thyroid anlage is an outpouching of the floor of the primitive pharynx. The distal end of this pouch becomes the thyroid gland,

and the connecting neck, if it persists, the thyroglossal duct. This is usually but not always situated in the midline (Ward). The duct normally atrophies during the sixth week. All stages of the development, including the fistula, the sinus (infected or noninfected), the cyst, and on down to the duct or merely the epithelial cord at the site of origin, have been observed in adults.

Persistent thyroglossal duct cyst is a rare complication of laryngeal operations but is important because it might suggest extralaryngeal extension of the malignant tumor of the larynx, resulting in poor judgment in the treatment. Secondly, the treatment of a cyst of the thyroglossal duct is surgical removal of the entire lesion together with a section of the hyoid bone. Such proper treatment of the cyst prolongs laryngeal operations considerably.

Forty-nine cases of congenital cysts of the neck were observed by Rees and Brown.[111] Eighteen of 30 patients with thyroglossal duct cysts were operated upon by the technique described by Sistrunk in 1920. When dissection reaches the foramen cecum, the authors modify the technique. They make a transverse incision over the cyst. In a case of a sinus they remove the sinus opening with a transverse elliptic incision, and they prefer to follow the contour of a crease when one is present. No recurrence or complication followed operation in any of their cases.

Parotid Gland Tumors.—In most reported series tumors of the parotid gland comprise 1% to 2% of all neoplasms. The classification of parotid tumors remains a controversial issue. Clarke[112] presents a modification of the classification by Rawson and associates as follows: (1) metastatic in the parotid area, (2) primary in the parotid, with subheadings of (*a*) benign epithelial tumors, and (*b*) malignant epithelial tumors, and (*c*) miscellaneous. Their unpredictable manner of local and metastatic growth suggests that they all have some degree of potential malignancy.

In discussing the anatomy, Clarke points out that the facial nerve does not really pass through the substance of the parotid, but passes from the region of the styloid process at first posterior and then superficial to the deep lobe.

The author does not recommend either aspiration biopsy or routine sialography. He now uses aspiration biopsy only when there is a suspicion of cancer of the parotid.

The technique of simple parotidectomy is described and illustrated. Deep lobectomy is required when a parotid tumor arises in the deep lobe or extends into it. In radical parotid excision, block dissection of the involved tissues is best carried out as the primary procedure, the technique of which is given. Ligation of the external carotid artery, which is well established and a quite innocuous procedure, is discussed.

Malignant parotid tumors are cured only if the entire primary tumor and its secondary deposits are removed. Sacrifice of the facial nerve may be necessary to accomplish this objective. Suprahyoid or radical neck dissection usually is required. Upon completion of surgical and radiation therapy specific measures may be taken to correct residual deformities.

If the facial nerve injury is known to be permanent, then a permanent lateral tarsorrhaphy should be performed. If salivary secretion continues to accumulate or if a salivary fistula develops, Clarke's policy is to give 900 to 1200 roentgens to the parotid area in divided daily dosage of 150 to 200 roentgens per dose, which usually produces prompt relief within three to five days.

McNealy and McCallister[113] prefer the following classification of tumors of the salivary gland: cyst, adenoma, adenocarcinoma, mixed tumors, entodermal cyst, and tumors of nonglandular origin. They point out the fallacy of waiting for the lesion to grow larger, among other misconceptions concerning management of the tumors. There would seem, in their opinion, no rational objection to operation on the basis of fear of injury to the seventh nerve. Nearly all parotid tumors are definitely radioresistant.

The authors condemn local excision of a parotid tumor. Superficial lobectomy will

provide adequate tissue excision in most cases. Preservation of the facial nerve is held to be of great importance, but secondary in importance to complete excision of the neoplasm.

The records of 280 patients with neoplasms of the parotid gland were reviewed by Maxwell, Buxton, and French,[114] of the University of Michigan Hospital, Ann Arbor. These were reclassified after thorough and critical study of the histopathologic sections. Malignant neoplasms of the parotid gland are mainly epithelial in type, although rarely sarcomas may be seen in these locations.

The designation pseudoadenomatous basal-cell carcinoma has been selected rather than cylindroma, adenomyoepithelioma, and adenocystic or adenoid cystic basal-cell carcinoma for three reasons: 1. The neoplasms are composed of small basal cells with little basophilic-staining cytoplasm and relatively large hyperchromatic nuclei. 2. A true glandular pattern is not seen. 3. In most instances the hyaline stroma of the so-called cylindroma was not the conspicuous feature of these neoplasms.

After reclassification, it was found that in 67 instances neoplasms previously interpreted as being malignant might be placed in the group of benign tumors.

Follow-up studies were made on all patients during the early part of 1952.

For mixed (benign) tumors wide local excision has been adequate. A distinct effort should be made to preserve all of the facial nerve in every instance. The squamous-cell and gland-cell carcinomas, except for the lymphoepitheliomas, require wide excision with a radical neck gland dissection. It is probable that a better planned surgical attack upon the pseudoadenomatous basal-cell tumor will result in an improved prognosis.

The authors believe that roentgenotherapy may be of greater value in the treatment of lymphoepitheliomas than any form of surgical treatment which they have been able to utilize.

A simple, adequate, and safe surgical approach to the parotid gland especially useful for otolaryngologists is presented by Weille,[115] together with an illustrative case report.

The intimate relationship of the parotid to the temporal bone and external auditory canal provides an easy approach from behind, permitting the aural surgeon to utilize his intimate knowledge of this region in obtaining adequate exposure. The method has certain other fundamental principles.

The aural approach to surgery of parotid lesions, whether tumor, stone, or infection, has given the author the greatest assurance of controlling unavoidable risks, and the best end-results. The technique described offers maximum protection both to facial nerve and to the internal jugular vein. A curved incision is made, preferably in a skin fold, from the external surface of the mastoid, near the auricle, downward and forward about 2 cm. below the angle of the jaw to the region of the great cornu of the hyoid bone. A further incision is made closely anterior to and parallel with the lamina of the tragus in its lower portion, and carried downward, then backward, exposing the perichondrium of the external auditory cartilaginous canal, to join the initial incision at a right angle. The lowermost portion of the lamina of the tragus is dissected medially to the porus acusticus. When the mandibular branch of the facial nerve near the angle of the jaw can be followed to the lower main trunk, if this is desirable, the dissection can be continued in any direction with maximum safety regarding calculated risks.

An incision for operation for benign conditions of the parotid gland is made by Byars[116] along the anterior and inferior margins of the ear, extending behind the ear and then down a crease in the neck. This method of facial nerve identification and dissection was designed to decrease the risk of injury to the nerve and to simplify the technical procedure in the course of operations for benign conditions involving the parotid gland region. The author recommends locating a major segment of the nerve early in the operation so as to determine its relationship and establish a starting point

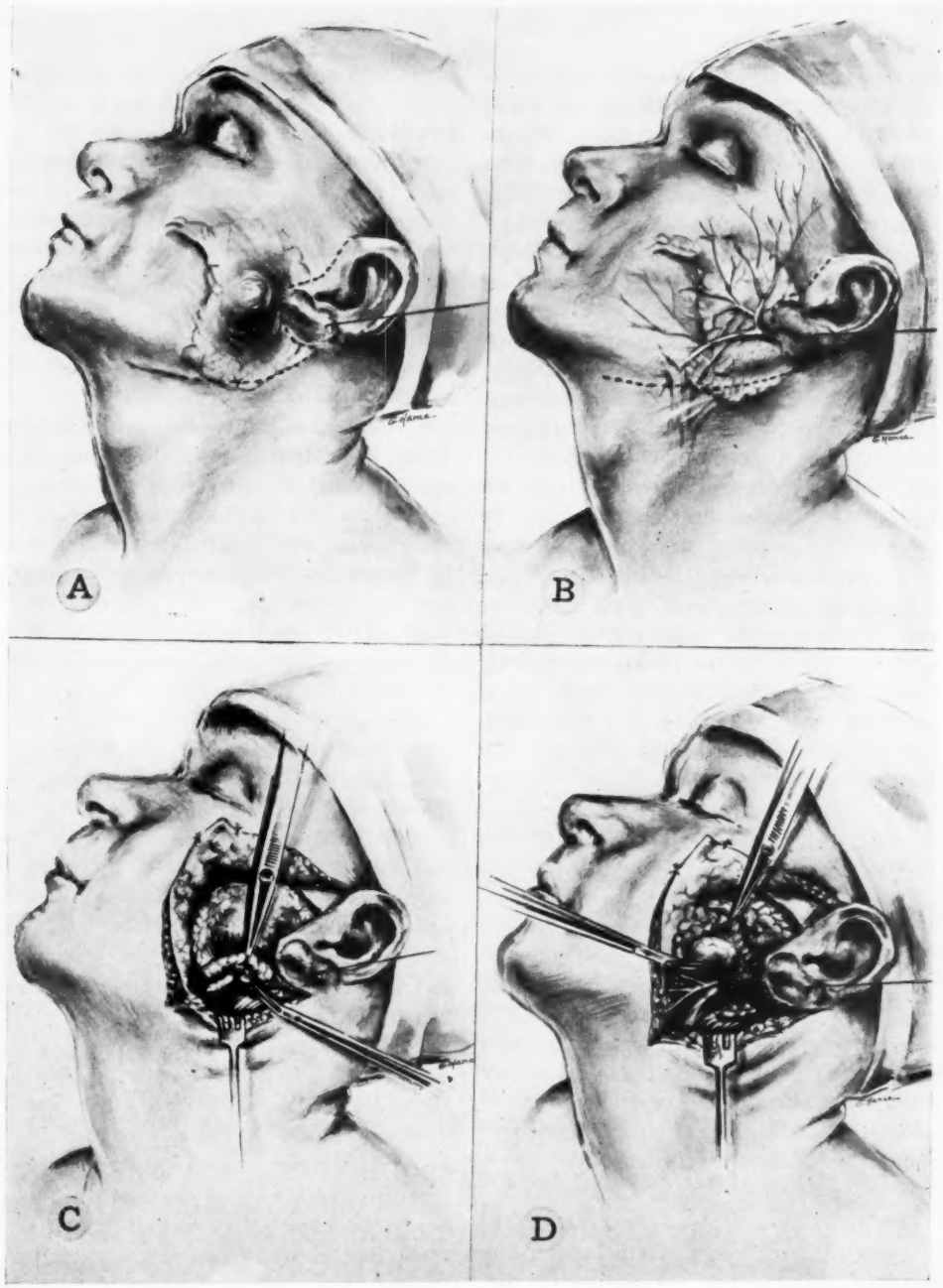


Fig. 7.—*A*, operation on the parotid gland without adequate exposure of the area invites paralysis of the facial nerve. An incision as indicated with wide reflection of the skin flap provides this exposure. The resulting scar is eventually as unnoticeable as any properly executed transverse incision in a flexion crease of the neck.

B, diagrammatic representation of skin incision, parotid gland, facial nerve, and posterior facial vein relationship. The divisions of the facial nerve vary, but the associations of the posterior facial vein and the anteriorly placed lower division of the nerve are reasonably constant. This division of the nerve may cross the vein on its deep or superficial side.

C, skin flap is reflected widely: As the lower pole of the parotid gland is separated from the sternomastoid muscle, the posterior facial vein is encountered emerging from the anterior central portion of the tip of the lower pole of the gland. This vein continues inferiorly deep to the sternomastoid muscle. If a vein is found which passes inferiorly in the platysma muscle superficial to the sternomastoid muscle, it is one origin of the external jugular vein and dissection should be constinued forward to locate the posterior facial vein.

D, the lower division of the facial nerve is easily located by searching immediately in front of the posterior facial vein within the substance of the parotid gland.

(Reproduced by permission from Byars, L. T.: Ann. Surg. **136**:414, 1952, J. B. Lippincott Company.)

for its visualization. Safe and curative removal of benign tumors of the parotid gland cannot be done, in Byars' opinion, without combining tumor removal with simultaneous facial nerve dissection.

Barclay,[117] of the Toronto Western Hospital, found that in all except three cases of parotid salivary fistula he has seen the lesion resolved spontaneously. These cases are reported, with an additional one in which the salivary fistula healed spontaneously in about six months after the wound had been sustained. He found repair by wire efficient but advises that care be taken not to shorten the duct any more than necessary when the cut ends of the duct are freshened prior to repair.

It seems rather remarkable to Barclay that permanent salivary fistula is so relatively rare, considering the liability of the parotid duct to division in, for instance, glass cuts from motor accidents. As far as he could ascertain, there is no case of permanent parotid salivary fistula reported in the English literature since 1945.

Neoplasms.—Pickrell and his colleagues,[118] of Duke University School of Medicine, hold that tumors and cancer in children are primarily a problem of either the general practitioner or the pediatrician. Early recognition by the pediatrician and careful study by the surgeon and the radiologist in consultation with the pathologist are indispensable in arriving at the correct diagnosis, and often in assisting in the actual treatment. Even with benign tumors the fact of more rapid growth in children would accentuate the importance of instituting prompt and aggressive therapy.

Definitive treatment to the present time consists of surgery, irradiation, and use of nitrogen mustard and the radioactive isotopes. Investigative methods of therapy include anticancer polysaccharides, urethan, and folic-acid antagonists.

The authors discuss blood and vessel tumors, malignant melanomas and pigmented nevi, lipomas, neurofibromas, sarcomas, and soft-tissue tumors. They give representative cases with treatment producing alleviating results in various types of tumors, such as irradiation of a cavernous hemangioma, followed by use of a marsupialized flap of the upper abdomen; surgical removal of hemangioendothelioma of the lower eyelid, canthus, and nose, followed by repair with an interpolated flap from the upper lid; sodium morrhuate injections for massive cystic hygroma involving the cheeks, chin, and neck and surgical excision of another circumscribed cystic hygroma.

Cervical adenopathy, although a common finding in children, may not always be indicative of an inflammatory condition. Surgical excision of an enlarged cervical node, however, should not be carried out until a careful search for the primary cause or source has been completed.

Cysts and neoplasms of the maxillary antrum are given primary consideration by Weaver.[119] He finds that most cancers of the antrum are squamous-cell epitheliomas, some are adenocarcinomas, and others sarcomas of various types. Cancer which originates in the ethmoid sinus frequently involves the antrum; basal-cell epitheliomas of the skin and tumors that originate on the alveolus may involve the antrum; basal-cell epitheliomas of the skin and tumors that originate on the alveolus may involve the antrum by secondary invasion. Roentgenograms and biopsy are the only reliable diagnostic measures. Metastasis is late in the course of the disease, and submaxillary and internal jugular nodes usually being involved primarily. The eradication of the local tumor is of major importance. It seems likely to Weaver that direct application of radium to the tumor would be more effective than the use of roentgen rays which pass through relatively normal tissue before reaching the tumor. Weaver believes that the use of surgical diathermy in the form of electrocoagulation which destroys tissue by dehydration is an improvement over the actual cautery. The available evidence indicates that tumors of a low grade of malignancy can often be completely eradicated by electrocoagulation if

this is thorough. Tumors of a high grade respond reasonably well to irradiation, with adequate drainage. Medium-grade tumors respond best to a combination of electrocoagulation and radium therapy.

Most large benign cysts and tumors and malignant tumors of the mandible demand not only a resection of a portion of the jaw bone but also, in the more extensive cancers. excision of the associated portion of the cheek, floor of the mouth, tongue, and lateral neck as a composite mass. Conley [120] gives the indications and contraindications for immediate free bone grafting in restoration of tissue loss after excision of the involved parts. This restoration is accomplished by the use of a free osteoperiosteal bone graft maintained in position by a special internal Vitallium plate.

The surgical approach to all malignant tumors of the mandibula, alveolus, or mucous membrane associated with the jaw bone requires entrance to the oral cavity.

Seventeen consecutive cases are reviewed in which 12 patients had cancer, 4 had adamantinoma, and 1 had myxoma. All of these patients are alive and free of disease at this time. Eighty-eight per cent of the patients have retained their original graft, and in one of the two cases of failure regrafting was successful.

According to Wass,[121] of London, simple tumors of the maxilla arise from either the bony or the dental elements of the jaw. Simple bony tumors are not confined to the upper and lower jaws but also occur in the other bones of the facial skeleton and in the bones of the cranial vault. They are fibro-osseous tumors of membrane bone. A localized tumor shows itself as a swelling in one of the membrane bones or as an enlargement of the whole of a bone, such as the maxilla. A diffuse tumor causes enlargement of several bones of the face and skull. Both types may range from an almost pure fibroma to an ivory osteoma.

There is no clinical or histological evidence that the fibro-osseous tumors are infective in origin. If they need to be removed, a simple paring-down of the tumor will be sufficient; subsequent regrowth rarely occurs. Wass believes that these fibro-osseous tumors of the membrane bones are simple aberrations of ossification in membrane. He regards them as different manifestations of bone dysplasia.

Osteoclastoma, or giant-cell tumor, occasionally occurs in the upper jaw. Fibroid epulis arising from the periosteum of the alveolar margin or of a tooth socket is an innocent fibroma.

Bony swellings in diffuse dysplasia of the upper jaw are differentiated from the diffuse type of fibro-osseous dysplasia in Paget's disease. Localized fibro-osseous dysplasia causing enlargement of the whole of one maxilla, without involvement of other bones, shows the same clinical and roentgenographic features as the diffuse type. Roentgenographically an osteoclastoma has the so-called "soap bubble" appearance, with areas of translucency intersected by coarse bony trabeculae. Large dental or dentigerous cysts, which also cause unilateral swellings of the upper jaw, must be distinguished by fluctuancy on its surface.

Localized fibro-osseous dysplasia sometimes produces a smaller tumor which is confined to the alveolar process or the lower part of the body of the maxilla. Adamantinoma, which is rare in the upper jaw, shows multiple translucent cystic spaces with fine bone trabeculae between them. A fibroid epulis grows on the surface of the jaw without producing local enlargement of the bone itself.

When the diagnosis of a fibrous dysplasia is certain, treatment should be conservative. In diffuse dysplasia and localized fibro-osseous enlargements involving the whole of the upper jaw, which occur most commonly in young patients under 20 years of age, operation should not be carried out until the growth period has ended and until the tumor is stationary in size.

Early operation should also be avoided in the uncommon types of benign enlargement of the whole maxilla which either continue to grow after the normal period or appear for the first time in middle-aged patients. Slightly more bone should be removed than

is needed to restore facial symmetry because healing of the raw surface is accompanied by some new bone formation.

The smaller tumors affecting the body or alveolar maxillary process can safely be removed at any stage, and can usually be excised completely. In combination with the use of antibiotics Wass has recently been closing the cavity completely, and has obtained healing by first intention in most cases.

Malignant Growths. — As stated by May,[122] surgery is the preferred treatment for cancer of the lip. In very small cancers of the lip confirmed by microscopic examination, irradiation may be more suitable. Widely infiltrating lesions may be best dealt with by a combination of irradiation and surgery. A radical unilateral dissection of the cervical lymph nodes is performed if the nodes are palpable. A so-called routine prophylactic neck dissection for seemingly uninvolved nodes is not carried out.

In the closure of the defect the aim should be the replacement of the missing structures —skin, muscle, mucous membrane, and vermilion border—by similar structures. Therefore, tissue from the immediate neighborhood should be used unless the defect is so large that this cannot be done.

Greer and his associates,[123] of the George Washington University School of Medicine, describe and illustrate with diagrams a surgical method for removal of an entire carcinoma of the floor of the mouth, including an adequate margin of normal tissue. This must include the anteriorly placed extrinsic and a portion of the intrinsic muscles of the tongue, all muscles and tissues beneath the floor of the mouth except skin and platysma muscle, and either periosteum or the inner table of the anterior mandible. This excision will include submaxillary ducts, both submaxillary glands, as well as all nodes anterior to the posterior belly of the digastric muscle and above the hyoid bone.

The hyoid bone and the posterior belly of both digastric muscles are exposed by transverse incision or by transverse and vertical incisions, and skin flaps beneath the platysma muscle up to the lower border of the mandible are elevated. The submaxillary nodes and glands are removed on each side, beginning posteriorly, and the dissection carried forward to the posterior border of the mylohyoid muscle. The periosteum and muscle attachments are now separated from the inferior border and inner surface of the mandible. A segment of the mandible is removed. The floor of the mouth is delivered following division of the anterior mandibular segment and origins of the mylohyoid, geniohyoid, and anterior digastric muscles. A good portion of the epithelial surface of the dorsum of the tongue can usually be preserved by incising the tongue on the bias.

The authors hold that their method does not result in objectionable deformity of the face, yet remains a sound cancer operation.

Ewing and Foote [124] report on a study of 27 cases at the Memorial Hospital, New York, between 1936 and 1950 in which the patients had histologically proved plasma-cell tumors in the mouth or upper air passages.

The cases are classified in three groups: (1) a tumor immediately recognized as only one lesion of multiple myeloma, (2) apparently solitary lesions confined to the soft tissues, and (3) apparently solitary lesions with evidence of local involvement of bone.

The tumors of the first and third groups were clinically alike and simulated cancer closely. Only those in the second group seemed to be in any way distinctive.

Microscopically plasmocytic tumors show structural deviation of variable degree. Ewing and Foote state:

> Such changes concern individual cells and not the over-all arrangement of the tumors. They include double and multiple nuclei, single gigantiform nuclei with uncharacteristic chromatin arrangement, and cells easily identified as plasmocytic but of two to three times normal size. The rate of mitosis, usually quite low, sometimes is distinctly elevated to around 10 per cent.

The authors agree with Stout's conclusion (1949) that the plasmocytoma is "potentially, and often in fact, malignant."

It is not uncommon for a patient with multiple myeloma to present himself first with trouble in his mouth or upper air passages. The authors believe that solitary plasmocytoma and multiple plasma-cell myeloma are certainly in the vast majority, on the basis of present information, only variants of the same disease process. This is as true of the disease when it occurs in soft tissues as when it is limited to bone.

It seems essential to Ewing and Foote both in the original clinical study of a patient with a plasmocytoma in the nose or mouth and in his subsequent follow-up to look carefully for the stigmata of multiple myeloma.

Erich [125] classifies tumors of the jaws in four groups which facilitate diagnosis and treatment. 1. In intraoral tumors arising in the soft tissues adjacent to the bones of the jaw diagnosis and treatment are comparatively uncomplicated. 2. Cystic tumors which arise within the bones of the jaw are all benign except adamantinomas which are restricted radically by surgical diathermy. 3. Tumors originating within the bone produce a defect that is filled with some abnormal tissue, and usually should be removed by electrocoagulation. 4. Tumors with a moth-eaten appearance of the bone roentgenologically due to malignant destruction can be removed with surgical diathermy or resection of the jaw; a few respond well to combined interstitial and external irradiation.

Small carcinomatous lesions of the buccal mucosa are excised or irradiated. If the lesion is extensive, a full cheek resection with lined pedicled flap replacement must be done. Carroll [126] favors a complete homolateral neck dissection combined with hemimandibulectomy and hemiglossectomy in all instances of moderately advanced carcinoma in this area. If the lesion approaches the midline, a simultaneous contralateral submaxillary dissection in continuity should be added.

Conley [127] considers surgical therapy the treatment of choice for all tumors of the mandible. He illustrates various approaches and resections of the alveolus and mandible for different types of lesions. Wounds produced by removal are repaired immediately; reconstructive surgery may be performed immediately in many instances, depending upon the warranty. In other instances it is delayed and carried out as a secondary procedure or delayed indefinitely. He classifies these reconstructive and rehabilitative procedures as onlay graft and bone chips, bone graft from the iliac crest (autogenous), rib grafts (autogenous), inert implants, homogenous refrigerator bone, and oral prosthesis.

In the case of metastatic squamous carcinoma in the region of the right submaxillary triangle, reported by Morfit,[128] of the University of Colorado School of Medicine, a right radical neck dissection together with a partial jaw resection was carried out, followed by a left radical neck dissection. No marked rise in the cerebrospinal fluid occurred until the interruption of the second jugular vein in the course of the neck dissection on the left side. Each time an abnormal reading in the cerebrospinal fluid pressure was obtained, this was countered by drawing off fluid through a continuous spinal needle.

The danger of immediate mortality following these radical procedures comes first of all from respiratory obstruction resulting from postoperative edema. In Morfit's opinion, this threat can be surmounted by the routine adjunct of a tracheostomy, which will serve until the edema has subsided and exchange by the normal pathways can be resumed.

From the clinic of the University Hospital, New York, Lyall and Schetlin [129] present an analysis of an unselected series of 76 cases of carcinoma of the tongue treated between 1935 and 1945. The primary lesion was attacked surgically in 66 patients.

Generally speaking, the tongue lesion is removed by the knife or the electrocautery, combined with a block dissection of all the superficial and deep cervical nodes. The primary tumor must be under control before neck dissection is attempted. It has been the authors' policy to recommend bilateral complete prophylactic node dissection for carci-

noma of the tongue in all patients with a reasonable life expectancy.

Kirchner and Malkin [130] studied 235 cases of proved cancer of the larynx observed at New Haven Hospital between 1921 and 1951. Age at onset of symptoms in 65% of the cases was between 50 and 70 years, with women tending to get the disease at an earlier age than men.

Hoarseness and cough in 81% and 43% of the patients, respectively, were the most frequent presenting symptoms. Unilateral painless neck swelling was the first symptom in a surprisingly large number of patients—6%.

Ninety-five per cent of the lesions were epidermoid carcinoma.

Thirty-one per cent of the patients were treated by surgery, 48% by radiotherapy, and 21% by a combination of surgery and irradiation. The over-all five-year survival rate in the cases in which treatment was given was 34.2%.

In studying the complications of treatment, Kirchner and Malkin were particularly impressed by two factors: (1) the decreasing incidence of postoperative infection with the use of antibiotics and (2) the importance of eliminating oral sepsis and extracting carious teeth before operation in minimizing wound infection and fistulas.

Pierce and his colleagues [131] believe that irradiation therapy of basal-cell epithelioma, especially near the nasal cavity or the orbit, will result in a small percentage of failures and disastrous effects. If irradiation is followed by recurrence, surgical excision should be carried out with no further irradiation. Of all similar lesions when the initial treatment was adequate surgical excision, there is no record of recurrence.

In excision the authors find a margin of 0.5 cm. from the tumor sufficient.

15 Washington St. (2).

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Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

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Joint Meeting, Oct. 11, 1954

Nasolacrimal Surgery. Dr. J. Vernal Cassady, South Bend, Ind., and Dr. Gordon H. Scott.

Dr. J. Vernal Cassady: Since ophthalmology and otolaryngology have separated, the distance between them anatomically is not the same distance that it was when both were practiced by the identical physician. Such a combined meeting as this helps us to take stock of the other's approach to similar problems. Unity and friendship so essential to the dignity and usefulness of our profession is cemented by this type of combined association and is just as important as is its educational value.

Before rushing in to treat lacrimal drainage obstruction, we should be sure that such a problem exists and that it is not simply a matter of excessive lacrimation. When we investigate lacrimal drainage, the position of the punctum and the presence of allergic rhinitis or sinus disease should be considered before exploring an obstruction in the lacrimal duct, which may be functional or secondary.

If lacrimal duct surgery is necessary, the Dupuy Dutemps method of dacryocystorhinostomy is advocated and used by most ophthalmologists. Unless the new nasal opening is lined with mucous membrane, it often will not remain patent but tends to scar over and cause recurrence of the obstruction. Some refinements of the original Dupuy Dutemps surgery are pointed out: the use of the Strycker saw for trephining into the nose and the use of small curved D and G No. 269 dacryocystorhinostomy suture needles instead of the Reverdin needles originally used. The importance of a large new opening into the nose, the removal of the lacrimal spur at the lower end of the anterior lacrimal crest, and a method of incising the nasal mucosa to facilitate its suturing are depicted in the film presentation.

Dr. Gordon H. Scott: Sixty-three cases of chronic dacryocystitis were operated upon intranasally by the West technique. Good results were obtained in 58 cases, fair in 1, and poor in 4.

The ostium should be made by removal of portions of the frontal process of the maxilla and of the lacrimal bone. The opening should be adjacent to the root of the middle turbinate and high enough to expose the cupola of the sac. Complete removal of the medial wall of the sac ensures clearance of the orifices of the lacrimal canals which enter the sac in its upper third.

Failures could be attributed to inadequate bone removal or a narrowing of the lumen in the lacrimal canals. One case was relieved by inserting plastic tubing in the inferior canal for four days. Had this material been available earlier, there might have been fewer failures.

DISCUSSION

Dr. Maurice D. Perlman: I thought that it might be of interest to tell you that during February of this year Dr. Iliff, of Baltimore, presented a technique in which he used a soft rubber catheter, attached to the lacrimal sac and coming out through the nostril, to maintain the opening and to assure close apposition of the sac to the nasal mucosa. We have tried this on a few cases at the infirmary and are disappointed because the soft rubber catheter apparently induced hyperplastic scar formation and unusual swelling in the operative site. Later, retraction of the caruncle occurred, which was disfiguring. I thought that it might be of interest to report these experiences.

DR. J. VERNAL CASSADY: The method referred to by Dr. Perlman is similar, of course, to that of Stoltz and Gifford, in which they brought the end of the sac through the trephine opening with sutures down into the nose. We tried this, but failed to find that it would stay open. Dr. Gifford was still enthusiastic about it when I talked to him in New York.

Dr. Lester Jones sent questionnaires to a large number of medical centers asking what method of dacryocystorhinostomy was taught to their residents. Thirty-five per cent were done by the method I showed, the Dupuy Dutemps. Then another 25% were done by the method of Mosher and Arruga. He asked whether they had rhinologic examination before surgery, and 95% of the answers were in the affirmative. But the external method of dacryocystorhinostomy was used in 95% of the cases. I think the reason for this is that more of these cases come first to ophthalmologists rather than to otolaryngologists.

(Slide.) This is a section of a full-term stillborn infant, showing the nasolacrimal duct under the inferior turbinate, which, I think, shows how easy it is to have obstruction in infants. In the ducts I examined anatomically at the Carnegie Institute, 85% were closed at birth. In these cases there is a membrane over the lower end of the duct and it is important to open this up so that dacryocystitis does not develop later.

Related Lesions of the Orbit and Nasal Sinuses. DR. JACK P. COWEN, DR. LINDEN J. WALLNER, and DR. STANTON A. FRIEDBERG.

DR. JACK P. COWEN: Of the affections of the orbit, those producing asymmetric exophthalmos more frequently are the following: exophthalmic goiter, either of the thyrotoxic or the thyrotropic variety; then hemangiomata, chronic orbital granulomata or pseudotumors, mucoceles, and aneurysms; meningiomata, extension of malignancy of other paranasal sinuses, and primary malignant tumors of the orbit being next in importance; lastly, benign primary orbital tumors, dermoids and mixed tumors of the lacrimal gland, and lymphomata.

Asymmetric exophthalmos in a large series of cases was found to be due equally to neoplastic and non-neoplastic causes. Of the neoplastic orbital lesions producing exophthalmos, half were benign in origin, half were malignant. Seventy-five per cent of benign tumors of the orbit produce exophthalmos. Of the malignant variety, they were equally divided into those arising within the orbit and those entering the orbit secondarily; the latter will show x-ray evidence of involvement in 90% of cases.

DR. LINDEN J. WALLNER: The pathogenesis of inflammatory lesions of the orbit of nasal origin is explained by the anatomy of this region. The orbit is described as a four-sided pyramid, surrounded on three sides by nasal air sinuses. The frontal sinus forms the roof, the sphenoid and ethmoid form the medial wall, and the maxillary sinus forms the floor. The antrum is the most frequently infected of the sinuses, but it rarely leads to orbital involvement. Infection of the ethmoid sinus is the commonest cause of orbital cellulitis in children; frontal sinusitis is the most frequent source in adults.

The superior and inferior ophthalmic veins drain the area supplied by the ophthalmic artery. The superior ophthalmic vein receives the anterior and posterior ethmoidal veins, and has a large communication with the facial system by means of the angular vein. The inferior ophthalmic vein communicates with the pterygoid plexus. The two ophthalmic veins do not follow the artery out of the orbit, but leave through the superior orbital fissure to enter the anterior wall of the cavernous sinus. There are no lymphatic vessels or nodes in the orbit.

There has been little opportunity to determine the exact pathology of orbital cellulitis since antimicrobial therapy has been available. Occurrence of the disease is rare compared with former years, and it responds readily to chemotherapy. Even before 1938, when surgical exploration was performed frequently, there was disagreement as to the pathology. A subperiosteal abscess was often found, indicating that the correct terminology should be orbital abscess. The term cellulitis indicates a diffuse infection of the soft tissues of the orbit. This has been described but is probably rare. Orbital cellulitis or abscess and cavernous sinus thrombosis present edema and discoloration of the lids, proptosis and limitation of motion of the globe, and chemosis. These symptoms may all be explained by venous obstruction. This alteration of venous drainage would seem to be the common denominator, producing similar symptoms in diseases with widely different types of pathology.

Kodachrome transparencies were shown of a group of illustrative cases of orbital cellulitis and abscess in children and adults, mucocele, osteomyelitis of the frontal bone, early orbital

involvement from folliculitis of the vestibule, cavernous sinus thrombosis, and trauma of the orbit. The diagnosis and treatment were discussed briefly.

DR. STANTON A. FRIEDBERG: Large dentigerous cysts must be included among the lesions which may produce orbital complications. In this instance (slide) the cyst had caused destruction of the walls of the maxillary sinus and erosion of the infraorbital plate. As with mucoceles (slide), these cystic masses are likely to attain considerable size without causing pain, unless secondary infection supervenes.

In the group of benign tumors of the nasal passages and sinuses we often find that damage to adjacent structures caused by expansive growth is far more serious than one might expect from the histologic picture. Among the examples shown to illustrate this point are a vascular fibroma of the nasopharynx (juvenile nasopharyngeal fibroma) which had invaded the orbit via the inferior orbital fissure, a huge osteoma which occupied the greater portion of the right orbit and ethmoid region, and a chondroma arising in the nasal septum and invading all the sinuses. This benign giant-cell tumor of the sphenoid caused slight proptosis and diplopia. Chordomas of the sphenoid area may invade the orbit and nasal passages, as borne out by these slides of an illustrative case. Pituitary adenomas have been shown to extend intranasally via the sphenoid sinus in two patients described several years ago.

In the group of malignant tumors of the nose and sinuses, extension to the orbit often occurs in the usual course of the disease. Removal of the maxilla, sometimes with the contents of the orbit, may offer the best possibility of cure. Examples of these procedures were shown. Irradiation therapy is often successful in controlling localized lesions of the lymphoma group of tumors, but development of metastases or distant foci of disease may be anticipated.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Norman Leshin, M.D., *President*

Stanton A. Friedberg, M.D., *Secretary*

Monthly Meeting, Nov. 1, 1954

The Surgical Anatomy of the Facial Nerve and Parotid Gland. DR. BARRY J. ANSON and DR. RICHARD A. DAVIS.

The parotid gland together with its duct and the facial nerve were studied in dissections of 300 cervicofacial halves in order to provide additional information on the anatomy of each of these structures separately and to record the major aspects of their interrelationship.

The size of the gland is a highly variable feature; the vertical dimension (height) was found to vary between 6 and 9 cm. as extremes. In horizontal plane (width) the extremes were 2 and 5 cm.

Relationships of the gland vary, of course, with its dimensions. But in addition to differences which depend upon the extent of the area covered, heterogenicity in arterial and venous supply makes for further complexity. Related skeletal structures are also variable. The styloid process belongs in this category. Frequently absent or very short, the process occasionally attains a length of 3.6 cm.

Despite considerable variation in size, shape, and relationships, the parotid gland is invariably bilobed; the portions, superficial and deep, are connected by an isthmus. Between these leaves course the branches of the facial nerve and certain of the blood vessels which supply the face. Additionally, the "ductules" which join to form the single parotid duct of each side pass through this same interlaminar space.

Quite regularly the trunk of the facial nerve separates proximally into divisions, termed cervicofacial and temporofacial. In more than 80% of the cases these divisions, or the adjacent members of the set of five derived nerves, anastomose to form a plexus in any one of eight or more patterns. Intricate schemes heavily outnumber the simple. This plexiform set of anastomoses is likely to occur in the space between the leaves of the gland, the nerves then emerging from beneath the anterior margin of the superficial part.

The fascial investment of the parotid gland is strong externally, where the layer contains fascicles of the muscles of facial expression. Internally the gland is related to the deep fascia of the masseter. These layers do not enclose the gland tightly, and hence do not form a capsule in the usual meaning of the term.

DISCUSSION

DR. PIERCE THEOBALD: I am sure we all owe a great debt of gratitude to Dr. Anson for his usual masterly presentation. Those of us who approach surgery of the parotid gland with timidity will now have a more firm footing which will be helpful to us all. Although our timidity will not be decreased, we may approach the gland with more confidence than heretofore.

DR. M. F. SNITMAN: Those of us who are familiar with the anatomy of the parotid gland can appreciate the labor involved in the dissection of this large number of glands. In our experience I do not recall ever having seen a parotid tumor that was not superficial to the facial nerve and therefore in the superficial part of the gland. Is there perhaps some embryological reason for this?

DR. THOMAS C. GALLOWAY: I want to pay tribute to this beautiful anatomic study. I have had a somewhat different approach to parotid surgery from some operators. I have thought that by very closely following the intact capsule of the tumor, rather than first exposing the nerve, I have had fairly good success in removing such neoplasms. We hear about complete removal of the parotid gland, and I would like to ask Dr. Anson if that is surgically possible. Some advocate piecemeal removal, emphasizing that the nerve be left intact. It is my experience that the capsule generally pushes aside the facial nerve in cases which are at all favorable.

Developmentally and anatomically, is there any difference in the structure of the deeper portion of the gland which makes it less likely to develop a so-called mixed tumor of the parotid gland?

DR. BURTON SOBOROFF: I should like to ask one question which, although related to the anatomy of the gland, may be complicated by the presence of tumor. There has been some question whether it is best to approach the main stem of the nerve or best to find a peripheral branch and follow it back. I have felt that it was best to try to find a branch and trace it back to the main stem, feeling that this is safer. I should like to ask whether it is safe from an anatomic standpoint to follow one branch and, if so, which might be best to follow to the main stem.

DR. JACK A. WEISS: I should like to ask whether in these multilooped nerve branches one can be sacrificed without loss of innervation to the muscle it serves. Does a fractional loss ever occur, without losing the response of the muscle as a whole?

DR. BARRY J. ANSON: When I mentioned that a capsule (in the ordinary meaning of that term) was wanting in the case of the parotid gland, I think that statement was overstrong. The gland is invested by fasciae, but is not tightly covered as are, for example, the liver and the spleen. An outer layer contains the musculature of facial expression, while an inner stratum covers the muscles of mastication; the gland is lodged rather loosely between them.

I am baffled by the reported observation that tumors are more likely to occur in the superficial portion of the gland than in the deep. I can offer no explanation for this odd predilection.

Admittedly, reports on normal anatomy do not provide the surgeon with all the information needed to solve a clinical problem. Unfortunately, we have had no opportunity to study facial nerves distorted by parotid tumors. We should conduct such research as a sequel to the current phase of the investigation.

Regarding the matter of overlapping innervation, I am of the opinion that supply would be furnished through the plexiform arrangement of the various branches of the facial nerve. Specifically, were fibers from a temporal ramus severed, there would be, in many instances, auxiliary supply from a connecting branch of zygomatic source.

Based on anatomic experience, I would say that the facial nerve (for freeing of its branches) should be approached at its proximal portion, that is, near the point where it emerges from the stylomastoid foramen; attempts to identify and follow the small peripheral twigs may end in failure or, if successful, may require needlessly tedious effort.

Congenital Anomalies of the Larynx. DR. PAUL H. HOLINGER, DR. KENNETH C. JOHNSTON, and DR. FILMORE SCHILLER.

Statistical analyses of four groups of congenital laryngeal anomalies were presented: (A) congenital laryngeal stridor, (B) webs and atresia, (C) subglottic stenoses, and (D) cysts and laryngoceles.

Of 305 infants having the typical, flaccid larynx recognized as congenital laryngeal stridor, 199 were males, 106 females. The tubular epiglottis, fluttering arytenoids sucked into the glottis on inspiration, and the not infrequently associated funnel breast were of note. Nineteen infants, 9 males and 10 females, have been examined who have had congenital laryngeal webs. Thirteen had a tough, arched membrane involving the anterior one-fourth to seven-eights of the glottis; one was found to have a transparent sheet across the superior surface of the cords; in two the web appeared to be a fusion of the anterior two-thirds of the cord surfaces, and in three cases a supraglottic fusion of the anterior half of the false cords and aryepiglottic folds was found lying over the normal true cords. One infant, tracheotomized immediately after birth, had a complete laryngeal atresia. There were 34 infants (20 males, 14 females) with congenital subglottic stenosis; in 2 a gross deformity of the cricoid cartilage was responsible for the obstruction. Congenital laryngeal cysts have been observed in five newborn infants; three originated in the right laryngeal ventricle to cover the true cord and obstruct the glottis, and two originated in the left arytenoid and aryepiglottic fold, severely compressing the glottis. Fifteen adult patients with laryngoceles are mentioned in this category as having possible developmental anomalies; in 11 cases the laryngoceles were unilateral, in 4, bilateral.

Symptoms of most of the congenital laryngeal anomalies indicated laryngeal disease, but were not characteristic of any specific lesion. Most infants had symptoms of stridor, dyspnea, or cyanosis associated with a hoarse, weak, or absent cry from birth until examination. Roentgen studies included neck and chest films and fluoroscopic examination of the esophagus. Diagnosis was established by direct laryngoscopy, but in questionable cases a bronchoscope was passed between the cords and into the trachea to determine the level at which obstructive signs and symptoms were relieved as the scope was advanced. Treatment for the most part was conservative, with tracheotomy dependent on the symptoms of obstruction rather than upon the type of anomaly.

DISCUSSION

DR. THOMAS C. GALLOWAY: I should like to ask Dr. Holinger if he has used the scheme of Iglauer in congenital lesions. He used a device like a jeweler's ring, which is put on after splitting the web but leaving the margin until epithelization occurs. Tantalum has been advised for similar use. This is done intralaryngeally.

DR. BARRY J. ANSON: I am not prepared to explain the developmental origins of the anomalies exhibited in Dr. Holinger's excellent motion pictures. Perhaps I could be prepared to do so at one of the Society's meetings next year. This reply may seem to be too cautious. Actually it is not, since even the acquisition of suitable material for microscopic studies often entails lengthy and tedious searching. At the present time our laboratory possesses no specimens in the age groups needed for such an endeavor.

DR. PAUL H. HOLINGER: We have not used the ring Dr. Galloway mentioned. It is a technique which consists of placing a ring in the anterior part of the web and leaving it so that epithelization occurs before the web is cut. It would seem that there is some danger of the ring's being aspirated, and there may be danger of infection.

I did not mean to indicate that toxins alone are responsible for congenital anomalies, but certainly they are for some of them, as, for example, the toxins associated with German measles in the first trimester, often resulting in many congenital anomalies. This is one that may be effective. There are other factors, of course, and Dr. Anson will give us the answer next year.

Norman Leshin, M.D., *President*

Stanton A. Friedberg, M.D., *Secretary*

Monthly Meeting, Dec. 6, 1954

Giant-Cell Lesion with Brachial Plexus Symptoms (Case Report). DR. ARTHUR L. RATKO (by invitation).

This case is presented because of two unusual features: The progressive symptomatology was justifiably attributed to a concomitant disease process, and giant-cell tumors of the cervical vertebrae are rather uncommon.

The patient was a 19-year-old white woman, first admitted to Research and Educational Hospital with a tentative diagnosis of lupus erythematosus disseminatus on Sept. 19, 1951.

She had the typical "butterfly" erythema of the face and complaints of fever, anorexia, and marked fatigue. Bone-marrow biopsy confirmed the diagnosis. Intravenous corticotropin (ACTH) was administered; the symptoms rapidly subsided, and she was discharged from the hospital on Nov. 1, 1951. Thereafter the disease process was controlled by administration of vitamins, testosterone, cortisone (Cortone) acetate, and occasionally antibiotics. She was hospitalized in March and again in September, 1952, because of flare-ups but each time intravenous corticotropin produced a prompt remission.

In March, 1952, for the first time the patient complained of severe intermittent pain, numbness, and tingling in the left arm and shoulder, occurring in attacks lasting 5 to 10 minutes several times daily and leaving a persistent dull ache in the left shoulder. Physical examination disclosed no significant findings. A chest x-ray disclosed an enlarged left cardiac border and a hazy hemidiaphragm. During the next year the symptoms became progressively more severe and, although there was some response to intensified cortisone therapy, she was never free from pain and numbness.

On March 16, 1954, the patient was referred to the E. N. T. clinic for evaluation of a "lump" in the left side of the neck and slight dysphagia of about three months' duration. A firm smooth mass, approximately 2.5 cm. in diameter, was found under the lower third of the left sternomastoid muscle; the mass was slightly movable. There was slight bulging of the left posterolateral wall of the hypopharynx. An aspiration biopsy of the mass was done, as well as barium study of the esophagus, and cervical spine and chest films. The barium study and chest films were essentially normal. The spine films, however, disclosed a punched-out defect of C-6, and "washed-out" C-5 and C-7, and absence of intervertebral disks between these vertebrae. The aspiration biopsy was reported as "tiny fragments of fibrinous material containing sheets of large, atypical multinucleated cells," with a tentative diagnosis of "malignant appearing cells." Further biopsy with the patient under local anesthesia on April 5, 1954, disclosed the mass deep to the posterior border of the lower third of the sternomastoid muscle, measuring approximately 3.0 by 3.5 cm. It was pale and hard, and there was marked fibrosis with some distortion of the surrounding structures. It was felt that total excision was not feasible, and a wedge biopsy specimen was taken. The histopathologic diagnosis was "invasive giant cell tumor, probably originating from C-6."

Since lesions similar to this one are occasionally seen in the presence of parathyroid dysfunction, this probability was ruled out by appropriate laboratory studies. All previous x-rays were carefully reviewed. Surprisingly, a punched-out defect was clearly demonstrated in C-6 on the chest x-ray taken the first day the patient complained of pain, numbness, and tingling. The slowly enlarging defect was then noted on chest films taken prior to her first visit to our clinic. Two salient factors in establishing the malignancy of a giant-cell tumor are (*a*) clearly malignant histopathologic characteristics of the stromal cells and (*b*) their rapidly progressive clinical course. Since neither criterion of malignancy was present, the decision was made to treat the lesion as a benign tumor. The possibility of cord damage, if surgical excision and bone graft were attempted, precluded this therapeutic approach. Accordingly, a calculated tumor dose of 1090 r was delivered to the lesion via right and left lateral ports. A movable semirigid collar was prescribed to stabilize the spine, since further decalcification of the vertebrae was anticipated. A severe weeping erythema of the neck developed, which was attributed to the abnormal skin sensitivity in the presence of lupus. The reaction subsided rapidly following completion of therapy.

Repeated cervical spine films demonstrated the anticipated decalcification for a period of approximately two months, with no apparent change in the size of the bony defect. The mass in the neck, the hypopharyngeal swelling, and symptoms of pain and numbness gradually subsided simultaneously. A second course of radiation was delivered with a calculated tumor dose of 800 r from Oct. 18 to Oct. 27, 1954. Films taken on Oct. 18, 1954, showed increased sclerosis, which is probably indicative of increased calcification within the lesion. The patient was last seen on Oct. 28, 1954, and had no complaints of pain or numbness in the shoulder or arm, but had tingling if she wrote for excessive periods. The mass in the neck and the hypopharyngeal swelling have disappeared and she has gained approximately 10 lb., is working regularly as a secretary, and appears to be well.

DISCUSSION

DR. JOSEPH G. SCHOOLMAN: We have all had occasions when concentration upon one disease entity has obscured the picture of other things that may be present. In one dramatic incident which I published some years ago, a lymphoblastoma originating in a tonsil was

overlooked, or at least the diagnosis was put off, because of concentration upon the original pathology in that patient. We should keep in mind that, despite our original teaching that we should always look for one answer to all pathology, all cases do not fit that rule, and often more than one entity may be present.

DR. ARTHUR L. RATKO: Before the decision as to treatment was made there was quite a discussion. The orthopedic department recommended block excision and bone graft. Here we had three vertebrae almost completely destroyed; the brachial plexus, jugular vein, and posterior wall of the hypopharynx were matted to this mass. How one could possibly stabilize the spine after an excision of such magnitude was more than we could see. Further, the radical type of surgical procedure is usually reserved for the malignant type of lesion, and we felt that this was benign. One of the arguments against radiation therapy is that frequently osteogenic sarcoma and/or malignant giant-cell tumors have arisen in previously irradiated benign giant-cell tumors. One wonders, in going through the literature and noting series of cases in which little or no therapy, or even surgical therapy, was instituted and malignant tumors have developed at the site of a previously benign tumor, how radiation therapy can be indicated. The consensus is, however, that the choice of therapy depends upon the location and character of the lesion.

End-Organ Deafness. DR. KINSEY M. SIMONTON, Mayo Clinic, Rochester, Minn. (by invitation).

The concept of end-organ deafness as a distinct classification was elaborated by Mygind in 1947. Various characteristics of cochlear deafness had previously been noted by Ménière (1861), Shambaugh (1920), and Fowler (1920). The pathologic basis for the syndrome is thought to be disturbance of the hair cells in Corti's organ. Endolymphatic hydrops is assumed to be associated with end-organ deafness. Mygind produced perilymphatic hydrops associated with hearing changes of the end-organ type in experimental animals by creating excesses of water, salt, epinephrine, and pilocarpine and by induced inflammation of the middle ear.

Hearing changes characteristic of end-organ deafness are (1) elevated threshold for bone conduction, (2) flat or rising (bass deafness) curve for air-conduction threshold, (3) varying degrees of hearing loss, (4) poor discrimination for speech signals presented at high intensities, (5) recruitment of loudness for pure tones (best demonstrated by the binaural loudness balance test), (6) diplacusis binauralis dysharmonica, and (7) decreased threshold for pain from acoustic stimuli.

The presence of end-organ deafness supports the diagnosis of Ménière's disease. The findings are variable and must be correlated with the clinical history. Hearing may be normal during remissions in the early stages of Ménière's disease and in cases of Ménière's disease without endolymphatic hydrops (pseudo-Ménière's disease). The findings of end-organ deafness are most prominent during the active phase of Ménière's disease. The findings become less marked in late stages of the disease. This is presumably due to irreversible changes in the organ of Corti or the spiral ganglion. Evidence of end-organ deafness is absent in some cases of long-standing Ménière's disease.

In many instances deafness of sudden onset is of the end-organ type. Some patients who suddenly become deaf recover their hearing if the sudden deafness is of the end-organ type. They do not tend to recover hearing if the deafness is of nerve type.

Of the various signs of end-organ deafness, those which gave the best correlation with the diagnosis of Ménière's disease were a flat curve for air-conduction threshold, recruitment of loudness demonstrated by the binaural loudness balance test, poor discrimination, and variability of hearing. Tests for diplacusis were difficult to interpret. Results of tests for a lowered threshold of pain correlated poorly with the clinical diagnosis.

DISCUSSION

DR. JOHN R. LINDSAY: It was a pleasure to hear Dr. Simonton discuss this question in which we are all much interested. Tests for recruitment and discrimination have become of wide interest in recent years; we are gradually beginning to understand them. It seems that in end-organ deafness the poor discrimination as shown by the P B maximum discrimination scores goes along with the presence of recruitment, i. e., they have recruitment as shown by the loudness balance test and they have poor discrimination, and probably the two are related. We have been interested to find that when the lesion is beyond the end-organ, as in acoustic neuroma, and then probably also higher up in the cochlear pathways,

there is a different situation. We have recently seen two cases—one an acoustic neuroma, the other an angle tumor—in which there was a very good threshold of hearing for pure tones in the affected ear. We found no recruitment in those two cases. The first patient recognized that she could not understand speech over the telephone, yet her pure-tone threshold level by air conduction was around the 8- or 10-db. level; her threshold level for spondee words was around the same region, yet her discrimination for P B word lists was very poor. In that patient we used the Rush-Hughes recording and the discrimination score was low. Mr. Duncan Scott, who tested the case, found that by using another set of words spoken by a different voice the discrimination was relatively high. We find a large difference in the discrimination scores depending upon the recordings used. The second case showed similar findings; while there was a good threshold level for pure tones (i. e., up around 10 or 15 db.), no recruitment, and a good threshold level for spondee words, yet the discrimination score for the Rush-Hughes recordings of P B words was again away down.

It leads one to suspect that if we had a more difficult set of word lists with which to test these patients who have more centrally placed lesions, we might be able to demonstrate more clearly the loss of discrimination and this might then become a worth-while diagnostic sign. It has been recognized by some observers for a long time that in certain central lesions there might be relatively good hearing for pure tones but poor hearing for speech. Dr. Simonton showed one case of an acoustic neuroma with a fairly good threshold level for pure tones in which the discrimination score was 92%. It makes one wonder whether, if he had had a more difficult list of words spoken by a less clear voice, it might not have been possible to detect poor discrimination. In a recent article by Bocca and associates concerning temporal lobe lesions, they reported that they were able to demonstrate poorer discrimination in the opposite ear, but it was only when the test was made difficult by the use of a filter that it would show up.

Dr. Sherman Shapiro: The work which Dr. Simonton has done with regard to end-organ deafness is very important. I think, however, from a practical standpoint what we need more than anything else is something to tell us at what level the lesion is present; in other words, we must be able to diagnose a level above that of acoustic neuroma, and that, of course, is what has been so difficult. I believe that Dr. Simonton will agree, speaking from a practical standpoint, that the average otologist finds little trouble in diagnosing the usual case of Ménière's disease. I should like to ask Dr. Simonton how long he estimates the acute phase of end-organ deafness with the flat or the rising curve where there is no treatment, over how long a period?

Dr. Robert Henner: I should like to add my praise for Dr. Simonton's excellent presentation. An interesting phenomenon to observe in hearing testing an otosclerotic patient is that when you go from not hearing to hearing audiometrically, there will be a higher threshold loss of hearing, whereas if you go from hearing to not hearing, lower thresholds will be obtained. This variability in threshold that exists in conductive hearing loss as compared to the sharpness of threshold in nerve deafness is probably the same phenomenon that exhibits itself in the Luscher test. I am sure that people who are using this test will find it worth while. We are getting some valuable findings from it at present. Even better than the Luscher test for differentiating end-organ deafness are the speech discrimination studies. Speech discrimination scores going down are the best indication of increased recruitment. I think that it is part of the same phenomenon, but even more simple, and for that purpose the speechogram should be used more widely. If, for example, the speech discrimination scores become poorer as one raises the volume, then one is dealing with marked recruitment.

Dr. Simonton mentioned the diagnosis of Ménière's disease without deafness in a few cases. I do not know how that diagnosis could be made. He also mentioned treatment. I have never known any therapy that I could say really works. Spontaneous remissions are the usual course, and this, of course, interferes with evaluation of the results of therapy. I have discarded all treatment, and feel that my ultimate results are no different than when drugs and salt-free diets, etc., were used. I should like to know if anyone can definitely say that any treatment published to date has any value in treatment of Ménière's disease.

Dr. K. M. Simonton: How long does a flattened or rising curve persist? This is an extremely variable thing, depending upon the severity of the manifestations of Ménière's disease, the frequency of the attacks, and perhaps some other factors. Some persons maintain a variable hearing for many years; in others that variability fades out very quickly in the course of the disease. There are cases in whom deafness develops suddenly, who show evidence of end-organ type

of deafness, and who never recover the hearing. The persistence of end-organ deafness is an extremely variable thing; I cannot give an answer in time, since it varies so much with different cases.

So far as the discrimination curve is concerned, it is not the percentage of discrimination that is significant in differentiating the type of hearing loss. Decrease in discrimination when intensity is increased suggests end-organ deafness. In nerve lesions the discrimination curve levels off when intensity is increased. I feel that there are many factors in discrimination; the poor discrimination is not a factor of an end-organ deafness alone. For instance, in some observations we made on discrimination in quiet and noise, we had two men who had been railroad engineers, approximately the same age: 65 and 70. They had practically identical pure-tone curves, both as to the shape of the curve and the threshold. One could discriminate quite well, the other extremely poorly, which undoubtedly was due to something other than the cochlea and the spiral ganglia. Perhaps the older person with poorer discrimination had greater arteriosclerosis; perhaps his mental faculties as a whole were poorer. Each of these persons maintained that he heard well in the noises made by a railroad engine; this was not confirmed by the laboratory data.

With reference to the question about the diagnosis of Ménière's disease without deafness, let us go back to Ménière's original papers. Ménière described primary hearing loss in some persons, primary vertigo in others, and some in which the two manifestations appeared more or less simultaneously. I find many patients with Ménière's disease who have had two or three attacks of vertigo before developing loss of hearing or who have developed loss of hearing and subsequently developed vertigo. The diagnosis of Ménière's disease without deafness is made by the presence of recurring vertigo of a whirling type, quite characteristic of that found in Ménière's disease in absence of evidence of cochlear change. When we make this diagnosis it probably indicates a person who maintains vestibular symptoms without cochlear symptoms for a longer period than is usual.

I grant that the occurrence of spontaneous remissions makes evaluation of therapy of Ménière's disease difficult, yet one finds patterns of attacks and remissions in individual patients. One person will have attacks at long intervals; another will have attacks at shorter intervals; or there will be a series of episodes and then a remission. Among those who set up a pattern of attacks at short intervals, or a series of attacks followed by a remission, medical therapy often alters the pattern of the disease by inducing early remission of symptoms. I, for one, am going to treat patients with Ménière's disease, and treat them very actively.

Norman Leshin, M.D., *President*

Stanton A. Friedberg, M.D., *Secretary*

Monthly Meeting, Jan. 3, 1955

Ossifying Fibroma of the Paranasal Sinuses. Dr. Emanuel M. Skolnik and Elio J. Fornatto.

Four cases of ossifying fibroma involving the paranasal sinuses are described in detail. The first is an ossifying fibroma of the maxillary sinus, the second is an ossifying fibroma of the maxilla involving the antrum, the third a cystically degenerated ossifying fibroma of the antrum, and the fourth a cystic ossifying fibroma of the supraorbital region involving the walls of the frontal sinuses.

The diagnosis in each case presented both a clinical and a radiologic problem; the surgical treatment was complete excision. Correlating the data from cases previously described with our own experience, conclusions are drawn concerning the clinical behavior, the radiologic appearance, the histologic picture, and the surgical treatment of these tumors.

DISCUSSION

Dr. Emanuel M. Skolnik: A few points might be stressed. On examination of the x-ray films the convexity of the lesion is more significant than the irregularity in each case. In the literature we find that most patients presenting this lesion are under the age of 30. Frozen sections are not of great value, and one learns to use clinical judgment rather than section. On examination at surgery, the tumor presents a very granular type of tumor which almost crunches when it is removed. The diplopia present was due to involvement of the infraorbital plate in two cases.

DR. BURTON J. SOBOROFF: We have seen two instances of such tumors, one in the frontal region and one in the antral region, both of which were very extensive. Each showed the same benign picture. One was in a relatively young man who had done a great deal of boxing in school and in the Navy; he developed a swelling in the antral region. The other was in a woman a little older. In each case we did an extensive procedure.

DR. ELMER A. FRIEDMAN: I should like to bring out a point mentioned by Dr. Fornatto about the relationship of these tumors to monostotic fibrodysplasia. About nine years ago a young boy was referred to me with a tumor occluding the right external canal. X-ray of the mastoid showed a destructive process of the right mastoid bone. A biopsy specimen of the tumor of the canal was taken, and the pathologic report was of ossifying fibroma. A mastoidectomy was done and the tumor, which involved the entire mastoid, was removed as completely as possible. It had destroyed the posterior canal wall and occluded the canal. It was found to have enveloped the facial nerve. The facial nerve was laid bare from the horizontal canal to the stylomastoid foramen. It hung like a telephone wire without support. Postoperatively the patient had complete facial paralysis, which cleared completely after several months. After great difficulty the pathologist rendered a diagnosis of ossifying fibroma, locally malignant. Because of this the patient was given postoperatively a cancerocidal dose of radium therapy. Healing was uneventful, the posterior canal wall re-formed, the hearing became normal, and the patient is normal as of this time. Comparing the slides with subsequent reports in the literature, I thought that it would have been better diagnosed as monostotic fibrous dysplasia. Had this diagnosis been made, I would not have had so much anxiety, I would not have told the parents there was a malignant quality to the tumor, and I would not have used radium postoperatively.

DR. ELIO J. FORNATTO: Dr. Soboroff mentioned a patient who had been a boxer. Very probably that lesion was monostotic fibrous dysplasia, which represents an abnormal response of the bone to trauma.

As to total removal of the tumor, we did not remove it as widely as might have been done, and we did not get recurrence. The picture I showed was taken two years after operation and there was no sign of recurrence. We feel that we should not cause disfigurement by complete removal, but we do remove as much as possible without disfigurement. If it should recur, partial or total resection is indicated.

With regard to Dr. Friedman's case, there are two cases of ossifying fibroma of the mastoid reported in the literature. Unfortunately, we cannot make a clear-cut distinction between the two conditions. The only difference that exists is a prevalence of spherical islets in ossifying fibroma over the bony spicules characteristic of monostotic fibrous dysplasia. However, there are people who have demonstrated that there are intermittent stages between the trabecular and spherical types. Others have even considered the two terms as synonymous for the same condition. Nowadays, a histologic differentiation is impossible, in our opinion.

Otogenic Brain Abscess. DR. MAURICE F. SNITMAN, DR. HARKISHEN SINGH, and (by invitation) DR. JOHN H. GLADNEY and DR. JAMES R. SOFRANEC.

This paper is to be published in full in a future issue of the ARCHIVES.

DISCUSSION

DR. ROBERT LEWY: I have a rather deep interest in both these cases since I was responsible for the initial radical mastoidectomy. Probably there are several questions that may be germane to this discussion. The most pertinent is why were the patients not operated upon for brain abscess at an earlier date. There were not sufficient signs and symptoms to justify the diagnosis of brain abscess. The first case showed only somnolence, which was rather better after mastoidectomy. It was only when it became very suddenly more severe and papilledema was found that we decided to put in a needle. Circumstances must justify such radical action. The next question is when does one operate. Operation for brain abscess is performed when its presence is reasonably established. In the first case it was fairly clear that something was going on, and it was strongly suspected to be in the temporal lobe. The increase in somnolence, however, pointed to its being localized in the subtentorial area.

The second was more complicated in some respects, and not in others. One man thought that the patient had lateral sinus thrombosis, which accounted for the septic curve. Others of us argued that the original septic curve was not vascular in origin. Then a second dissent

caused us to call for a neurosurgeon. He did not feel that there was an abscess but that there was a vascular accident. That, combined with the temporary paralysis, helped pretty well in localizing the lesion, but it was difficult in the face of an expert opinion to the contrary to insist that a brain abscess was present. The result, however, proved this hypothesis to be quite correct.

DR. THOMAS C. GALLOWAY: In the old days this would have been the opportunity for a long acrimonious debate about how to treat brain abscess. At Cook County Hospital, Pearlman said to operate on a brain abscess when you had a diagnosis. It was my feeling that operation should not be done until it was walled off. The danger of rupture into the ventricle and of disseminated meningitis made early intervention hazardous, and I think that it was an advantage to wait. But recently I saw Dr. Tarkington handle a brain abscess in a more modern way. He dissected out the abscess relatively easily, and I thing the danger of scar tissue and secondary infection is slight with antibiotics. Dr. Alexander, of Vienna, had been very proud of his early results half a century ago, but on following them up later, he found most of them in asylums. We can be very grateful for this better handling of otogenic disease.

DR. MAURICE F. SNITMAN: I agree with Dr. Lewy about the question of delaying exploration because of the fact that in the first case all the symptoms—bradycardia, initial spinal fluid pressure of 300 mm. of water, somnolence, and low fever—could well have been due to otitic hydrocephalus. I think that most of us would have withheld surgery further. The second case was interesting in that the patient, having such a large abscess, following the mastoidectomy just went about his usual duties in a fairly normal manner, and the possibility of intracranial pathology would be difficult to suspect. In both cases one would expect some degree of facial weakness, but none was found at any time. As a general rule, the fundamental therapy is drainage from the abscess through an adequate dural incision. We are very pleased with the postoperative progress of both patients.

Glomus Tumors (Nonchromaffin Paragangliomas) of the Larynx: Case Report. DR. ALBERT H. ANDREWS JR.

A white man, aged 27, weight 200 lb., was first seen on Oct. 7, 1953, with complaints of intermittent mild hoarseness following an upper respiratory infection, dysphagia for harsh foods, and shortness of breath at night for two years, and variable elevation of blood pressure for nine years. There had been an increase in symptoms during the preceding three weeks.

Examination revealed a large mass on the left side of the larynx, dull red in color, producing complete fixation. The pharynx and right side of the larynx appeared essentially normal. Blood pressure was 168/100. Planigraphic x-rays of the larynx revealed a large mass in the left side extending from the level of the glottis to the midportion of the epiglottis. The mass appeared to be about 7 by 3 cm. in size. A tracheotomy was performed on Oct. 9, 1953, and was complicated by the occurrence of severe intermittent convulsions lasting for four hours. The convulsions were controlled with phenobarbital sodium and secobarbital sodium, using a total dose of 485 mg. over a period of six hours. During this time the blood pressure dropped to 83/50.

On Oct. 15, 1953, direct laryngoscopy was done under general anesthesia. The previous findings were confirmed, and the mucosa was found to be intact without evidence of neoplastic invasion. A rather deep biopsy specimen was taken, which revealed recent submucosal hemorrhages and dilated and compressed blood sinuses with thin muscular walls. The pathologic diagnosis was varix of the larynx, and the provisional clinical diagnosis was laryngeal hemangioma.

On the following day the urinary output decreased and signs of oliguria and a lower nephron syndrome were noted. The nonprotein nitrogen increased from 61.5 mg/100 cc. on Oct. 9 to 246 mg. on Oct. 26, 1953. The urinary output was decreased to less than 60 cc. on Oct. 16, then slowly increased. The patient was placed on the Brost diet, consisting of butter and cream (low carbohydrate and protein and high fat), and fluid intake was limited to 500 to 800 cc. He recovered and was discharged on Nov. 7, 1953.

On Jan. 28, 1954, a thyrotomy was done under intratracheal anesthesia. The hyoid bone was sectioned in the midline, and the laryngeal incision was extended upward along the base of the epiglottis on the left side. The tumor mass extended from the level of the vocal cord to the border of the aryepiglottic fold and occupied the entire left side of the larynx. The

ventricular band was very thin and compressed, with the ventricle collapsed. An incision was made anteriorly above the level of the vocal cords, then extended posteriorly along the superior surface of the left vocal cord. Extremely free bleeding occurred in spite of ligation of both superior thyroid arteries. The left superior thyroid artery was ligated at the left superior pole of the thyroid gland and thus controlled the bleeding. A clear line of cleavage was found, and the tumor was shelled out by blunt and finger dissection. The main mass of the tumor measured 4.6 by 2.5 by 2.5 cm. in maximum size; the second piece measured 2.5 by 1.5 by 0.8 cm. Microscopic examination showed a highly vascular stroma and large cells with vesicular nuclei and abundant, faintly granular eosinophilic cytoplasm arranged in small groups. Tissue removed from the tumor bed did not reveal tumor tissue.

The postoperative course was uneventful, and the tracheotomy tube was removed one month later. On last examination, Dec. 10, 1954, approximately eight months after operation, the voice was clear and slightly higher in pitch than preoperatively and had a quality usually associated with recurrent laryngeal nerve paralysis. His general condition was excellent, and the blood pressure was within normal limits. There was fixation of the left cricoarytenoid joint and a scar in the anterior commissure. The base of the epiglottis was slightly irregular. Both vocal cords were white, smooth, and straight. No evidence of neoplastic tissue was seen.

The biopsy was inadequate, undoubtedly because it was too superficial; this illustrates one of the problems in the diagnosis of a tumor which lies deep within the structure of the larynx. The convulsions complicating the tracheotomy were thought to be due to sensitivity to procaine, and the use of all local anesthetic agents has been avoided. The preceding hypertension was thought to be due to a mild glomerulonephritis, probably a complication of scarlet fever in childhood. The reaction to procaine and the drop in blood pressure secondary to the convulsions, and the medication used in its control, were considered to be the precipitating factors in development of the lower nephron syndrome.

Prognosis in this case is thought to be good, although the short time since the surgery and the slow growth characteristics of glomus tumors make a definite conclusion at this time impossible.

DISCUSSION

DR. M. F. SNITMAN: Was the possibility of parathyroid tumor considered?

DR. A. H. ANDREWS: This case was presented at the seminar of the Otolaryngologic Department of the University of Illinois, and Dr. Snitman reviewed the slides and came to the conclusion that it was a glomus tumor. Drs. Frederick C. Bauer, Edwin F. Hirsch, Cecil A. Krakower, and Robert Henner studied the histology and concluded that it was a glomus tumor.

Chondrosarcoma of the Nasal Cavity. DR. BURTON J. SOBOROFF.

Tumors of cartilaginous origin arising within the nose or paranasal sinuses are uncommon. They may be histologically benign enchondromas or malignant chondrosarcomas. However, their very location near vital structures in the head makes almost all such tumors clinically malignant. The usual course is a slowly progressive one, with persistent growth and expansion, gradually eroding normal bone about them and often invading the intracranial cavity.

We have had the unusual opportunity to observe the course of a patient who developed a chondrosarcoma which arose intranasally and, ultimately, extended into the cranial cavity. We have been able to correlate the developing clinical and x-ray findings with the actual pathologic changes as observed at surgical exploration and at the postmortem examination.

The diagnosis of cartilaginous intranasal tumors is established by biopsy. Many show a relatively benign histologic appearance, but certain criteria for determining malignant change have been suggested. Since their location within the nasal cavity makes the benign enchondromas as potentially dangerous as the chondrosarcomas, it would seem that the same treatment should be applied to all intranasal tumors of cartilaginous origin.

In the vast majority of cases, such tumors are radioresistant, responding only to a limited degree to radiation therapy. Most reports indicate that the treatment of choice is surgical excision of the tumor mass. Good exposure of the tumor developing within the nasal cavity or from the ethmoid region and projecting into the nasal cavity may be obtained by means of the Fergusson incision or a modification of it. Modern methods of anesthesia, good preoperative preparation, and the availability of whole blood will permit adequate exploration of these tumors and wide excision when feasible.

DISCUSSION

DR. LAWRENCE J. LAWSON: The pathology is very well demonstrated by these very fine kodachromes. Dr. Soboroff has given us an excellent discussion of the character of this tumor. I encountered many of the same problems with my patient, particularly with the inaccessibility of the tumor origin and the impossibility of wide margin removal.

My patient is now 80 years of age. She is very uncomfortable and requires continuous medication for pain. Dr. Gordon New removed the first tumor, which originated from the left side of the nasal septum. The diagnosis was chondroma. She was not seen until she appeared five years later at our clinic. She complained of right nasal obstruction and pain over the right antrum. The septum had been invaded by the tumor, which had also extended toward and into the right antrum. It has since invaded the orbits, and there is now complete nasal obstruction; she is blind from tumor pressure and tumor occlusion. A further report on this case will be given as opportunity permits. We have used deep x-ray therapy, which was for a time effective in decreasing the volume of the tumor. Perhaps extensive removal of the nasal septum at the time of the original operation might have eradicated the tumor.

DR. THOMAS C. GALLOWAY: I wonder if there may not be a better approach to this situation. Dr. Soper and I had a patient with a chondroma which had replaced the septum and sphenoid body. Operating within the capsule by a coring technique, I found everywhere smooth glistening capsule; there was no infiltration beyond it. That patient, who was in her 70's, went along for three or four years and died of something else.

I planned to operate on another case and was considering a technique which might have been satisfactory. It had a well-defined perichondrium of doubtful malignancy. I think that some of these tumors must develop from the perichondrium and if one could approach them from the inside and use zinc chloride to destroy the perichondrial lining the result might be better. If the capsule is torn, one gets dissemination. If one can destroy the tumor and capsule with diathermy, I think it is advisable, but it is almost never possible.

DR. M. F. SNITMAN: The photomicrographs clearly indicate a diagnosis of chondrosarcoma, and the postmortem findings are evidences of its growth potentialities. However, even the diagnosis of a true chondroma should place the clinician on guard and institute radical measures. An exact determination of the sarcomatous qualities in a supposedly benign chondroma is very difficult, and the interpretation will vary among several pathologists. Our experiences with such tumors, although infrequent, have been very unpleasant.

DR. BURTON J. SOBOROFF: I should like to thank the discussants who have added to the interest of the presentation. It seems to be fairly well agreed in most of the literature, including that of Geschicter, Copeland, Coley, and all the others, that the treatment of choice in chondrosarcoma is rather wide excision in any case where they try to conserve function.

If we were fortunate enough to see these cases early, with the means at hand surgically, and the Fergusson type of incision which gives good exposure, I think that wide surgical excision could be accomplished without extensive disfigurement and with much better results.

Norman Leshin, M.D., *President*

Stanton A. Friedberg, M.D., *Secretary*

Monthly Meeting, Feb. 7, 1955

The Effect of Anoxia on Cochlear Potentials. DR. CESAR FERNANDEZ (by invitation).

(No paper or abstract submitted.)

Labyrinthine Surgery for Ménière's Disease. DR. JOHN R. LINDSAY and (by invitation) DR. KARL H. SIEDENTOP.

The experiences with different types of labyrinthine surgery for Ménière's disease at the University of Chicago for the years 1940 to 1954 were reviewed. The results of animal experiments and of earlier operations on the labyrinth were reported before the American Academy of Ophthalmology and Otology in 1948. Although the animal experiments indicated that a differential destruction of the vestibular sense organs was feasible, the experience on humans was that any operation on the labyrinth which would consistently destroy vestibular function and thereby prevent the attacks of vertigo would destroy hearing in that ear as well.

It was also recognized by Day that the relief of tinnitus, sometimes a distressing symptom in this disease, was more likely to follow if cochlear function had been abolished. Both electrocoagulation (Day) and removal of the membranous canal with its ampulla (Cawthorne) have been relatively successful operative procedures. In this series there were recurrences of vertigo in 2 out of 9 cases after the former technique, and in 1 case out of 10 after the latter technique. The hearing was destroyed in all cases. Tinnitus continued unabated in four of the former and in four of the latter group. In an effort to improve the results it was decided to adopt a more radical operative procedure on the labyrinth. This consisted of exenteration of the ampulla of the superior and horizontal semicircular canals, thus making one large opening into the vestibule. The membranous structures in the vestibule were then ablated or destroyed. Coagulating current was not used. This procedure has been used in the last four cases, with good results. In our experience the destructive operation on the labyrinth gives satisfactory results in selected cases of Ménière's disease and is a safe procedure. The proportion of cases in which the operation has been considered to be advisable has in recent years ranged between 5%-10%.

DISCUSSION

DR. SHERMAN SHAPIRO: I think that we, and the profession as a whole, owe Dr. Lindsay a considerable debt of gratitude, both for presenting such a large amount of material and for such clear-cut conclusions. I have followed these operations with considerable interest for some years. I might say that I have not had any personal experience in labyrinthine surgery, except for the Neumann operation for suppurative labyrinthitis, because I have never found a case where I felt justified in doing this. I have always suspected from my own limited experience that one could not do anything with the labyrinth without destroying the hearing, and I am happy that Dr. Lindsay brings this out so clearly, because I think that will clear up a good deal of confusion. We must be prepared to tell such a patient that his hearing will be destroyed by operation.

A frequent problem involves the question of unilateral and bilateral Ménière's disease. Sometimes this is difficult to determine, and in many of these people one ear will be involved first and, due to factors, systemic or otherwise, present in that particular person, the other ear will become involved later. Practically, I find great difficulty in even considering an operation of this type. For instance, one patient whom I saw today, I have had under observation for a number of years. He has practically no hearing in one ear; in the other ear he has enough hearing so that he can converse. He has shown many times a marked spontaneous and postural nystagmus, particularly with the Frenzel glasses. I do not know which ear is responsible for the Ménière's disease, and I do not know whether this can be diagnosed. I do know, however, that this patient has been able to work and get along, even though he demonstrates some nystagmus most of the time. He is taking eight 50-mg. nicotinic-acid tablets daily, flushes beet red, but says that the medicine does him good. I suppose the good ear will ultimately go deaf, but for some years at least he will be a functioning member of society.

I do not know of anyone who has been doing this operation in this vicinity except Dr. Lindsay, and I think that he has done us a signal service in defining the strict limitations and the indications for it.

DR. ROBERT LEWY: We are much indebted to Dr. Lindsay for defining a better operation for intractable vertigo than we have had prior to this time. But there is a disparity which I am at a loss to explain. For eight years I have been working in a large public institution and we have not had any cases in which the Cawthorne or any modification of it was done due to the vertigo from which the patient suffered. I may be wrong, but I checked with another Michael Reese staff member and in the past 10 years I find that no such operation has been performed there. In my private practice, which is not the most extensive, my percentage of patients with vertigo is fairly high, but the percentage who have required surgery is zero. I know that if any person gets the reputation for doing a certain procedure, particularly if it is an esoteric procedure, cases tend to fall into his hands. Yet it seems to me that there may be some variations of indications in various institutions. I am certain that there are patients who require this type of surgery, but in my experience I have seen none.

DR. MYRON M. HIPSKIND: I feel compelled, in view of the two previous discussants' remarks, to present the other side of the story. I wish to emphasize that Dr. Lindsay stated in the first part of his presentation that the surgical correction of vertigo is indicated only in those cases that fail to respond to medical therapy. Some of you may recall a motion-picture

presentation of a case of intractable labyrinthine hydrops which I presented before this Society last year. You may recall also that I pointed out the unfortunate loss of the fingers of the right hand, which were amputated as a result of a fall during an attack of dizziness in which the patient, in an effort to break the fall, accidentally plunged his hand into crushing moving gears. This man had a loss for serviceable hearing in the affected ear. He was totally incapacitated because of his recurring attacks of dizziness. After the surgical procedure as outlined by Dr. Lindsay, the man regained his stability and has since been able to follow gainful employment. In these cases where there is a substantial danger to life, where medical management has failed to produce stabilization of balance, and where all serviceable hearing is lost, it is my feeling that they should be given an opportunity of surgical correction. I can speak of other cases that have had such a background in which surgery restored them to full functional and serviceable capacity.

DR. JOHN R. LINDSAY: I want to thank the discussants for their kind comments. The operation I have described is a very simple modification of a labyrinthectomy. Regarding the number of cases seen by different otologists, I do not know all the factors contributing to this experience, but I am sure that each week I see two or three new cases of vertigo. I think that this is a fair estimate without having gone over the cases accurately. The majority of these are not Ménière's disease, but are either postural vertigo or an attack of vertigo without auditory disturbance. I would estimate that we see 20 or more new cases a year that could be unmistakably diagnosed as Ménière's disease. It may be that they gravitate to certain doctors or clinics because of a special interest they are known to have in that problem.

Regarding the indications for surgery, one of the first pathologic specimens which came to me from Dr. Boies, of Minneapolis, was from a man who fell and sustained an injury, which resulted in my getting his bones. Another was a man who had not dared to walk out of his hotel alone for two or three years because of these attacks. Within four or five months after the operation he would go downtown or any place he wished. He made a rapid recovery for a man in his mid 70's. There was another patient who on several occasions was literally thrown across the table into the lap of the person opposite him. He called these attacks the "flip-flops" and is now very grateful because he has not done a flip-flop since. I just mention these because you might think that a person with Ménière's disease is not in danger. Another patient was driving along the road, had a sudden attack, and hit a telephone post. We agreed that something had to be done to prevent another such attack. I could tell you of more instances, but I only want you to realize that these people could not be controlled by other means and needed rehabilitation. However, I feel that the percentage of cases in which this operation should be recommended is low, certainly less than 10% in the cases which we have seen in the past 15 years.

Circulation of the Blood in the Living Cochlea. DR. HENRY B. PERLMAN and (by invitation) DR. ROBERT S. KIMURA.

The behavior of the blood vessels of the cochlea in the living animal has been studied by direct observation and motion-picture recording at suitable magnification. All the elements of the terminal functional unit of the vascular bed are seen, including arteriole, venule, capillary, and arteriovenous arcade. All the vessels that are anatomically present in the area are visualized, including vessels of the diameter of a red blood cell.

Direction of flow and rates of flow as well as relative diameter, shape of vessels, and vital staining for smooth muscle cells help to differentiate the radiating arteriole, arteriovenous arcade, spiral ligament capillary in scala vestibuli, the larger capillaries of the stria vascularis, the vessel of the spiral prominence, and collecting venules. The blood flow is very stable. There is no visible pulsation; there is no spontaneous vasomotion to close off vessels. Electrical stimulation of cervical sympathetics produces no noticeable change in this circulation while dilation of the pupil and marked slowing of the circulation of the middle ear mucosa is observed. The blood flow is markedly slowed with controlled asphyxia and temporarily increased with recovery from asphyxia. The vessels respond in anaphylactic shock by sticking of white blood cells, white cell emboli, temporary stoppage of flow in radiating arteriole, with the emptying of the vessel without collapse of its lumen. This response is similar to that observed in the peripheral blood vessels.

Occlusion of the inferior cochlear vein produces various degrees of slowing in this circulation. In some preparations the blood vessels of the spiral lamina and basilar membranes were also photographed.

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FOREIGN AND INTERNATIONAL

Canadian Otolaryngological Society
(Société Canadienne d'Otolaryngologie)

President: Dr. G. Edward Tremble, 1390 Sherbrooke St. West, Montreal, P. Q.
Secretary: Dr. G. Arnold Henry, 170 St. George St., Toronto.
Place: Bigwin Inn, Lake of Bays, Muskoka, Ont. Time: June 16-18, 1955.

International Bronchoesophagological Society

President: Dr. Antonio da Costa Quinta, Lisbon, Portugal.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Meeting: Fourth International Congress of Bronchoesophagology.
Place: Buenos Aires, Argentina. Time: Oct. 28-29, 1955.
President of Congress: Dr. Antonio Carrascosa.

International Congress of Audiology

Place: Leyden, Netherlands.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland.

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Pan-American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

President: Dr. Juan Manuel Tato, Azcuenaga 235, Buenos Aires, Argentina.
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Meeting: Fifth Pan-American Congres of Oto-Rhino-Laryngology and Broncho-Esophagology
Place: San Juan, Puerto Rico. Time: April 8-12, 1956.
President of Congress: Dr. Juan H. Font, Medical Arts Building, San Juan.

Sixth International Congress of Otolaryngology

President: Dr. Arthur W. Proetz, 3720 Washington Blvd., St. Louis.
General Secretary: Dr. Paul H. Holinger, 700 N. Michigan Ave., Chicago 11.
Place: Hotel Statler, Washington, D. C. Time: May 5-10, 1957.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Francis W. Davison, Geisinger, Memorial Hospital, Danville, Pa.
Secretary: Dr. Hugh A. R. Kuhn, 112 Rimbach St., Hammond, Ind.
Place: Atlantic City, N. J. Time: June 6-10, 1955.

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President: Dr. Algernon B. Reese, 73 E. 71st St., New York 21.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave., Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 9-15, 1955.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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President: Dr. Daniel S. Cunning, 115 E. 65th St., New York 21.
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Place: Seigniory Club, Montreal, Canada. Time: May 11-12, 1956.

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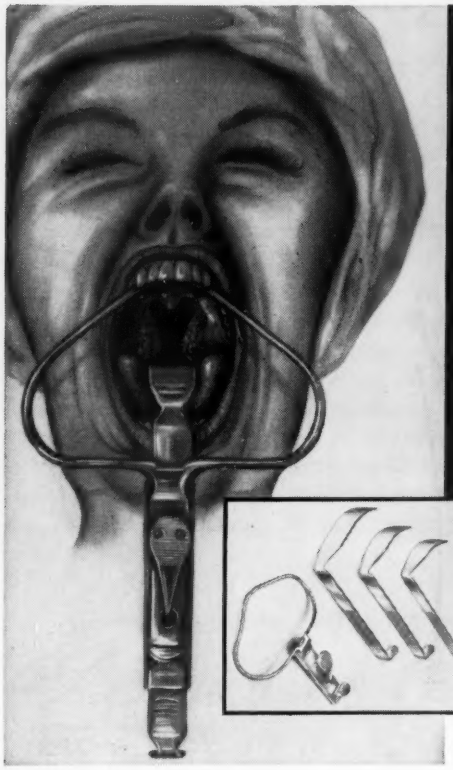

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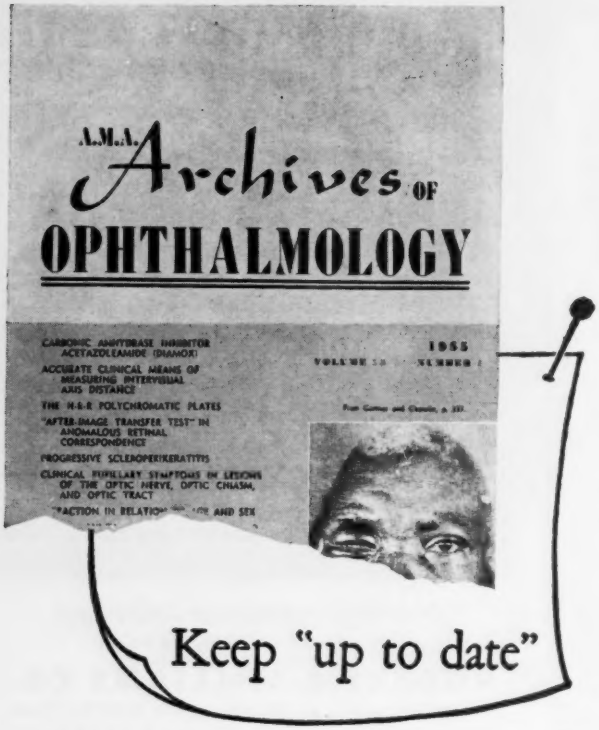
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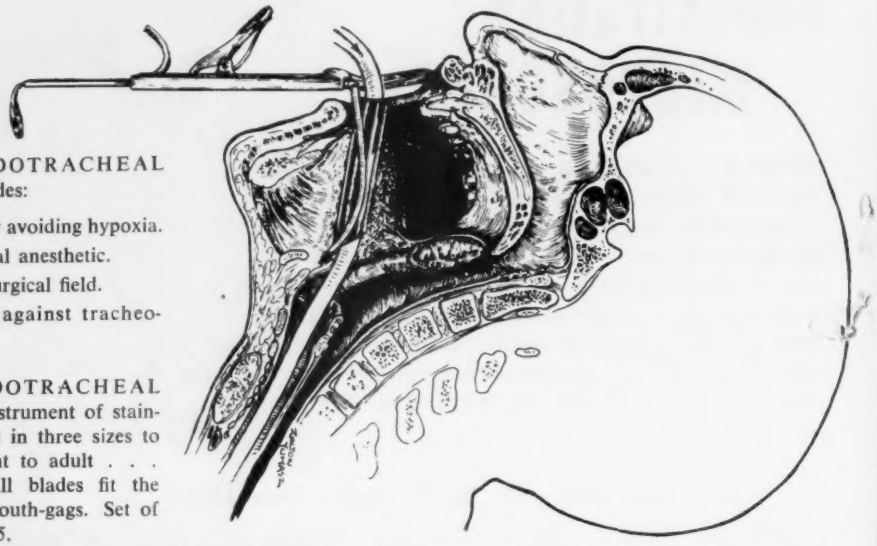

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*Barton, R. T.: Instrument for endotracheal anesthesia during oro-pharyngeal surgery. J. A. M. A. 153:1017 (Nov. 14) 1953.

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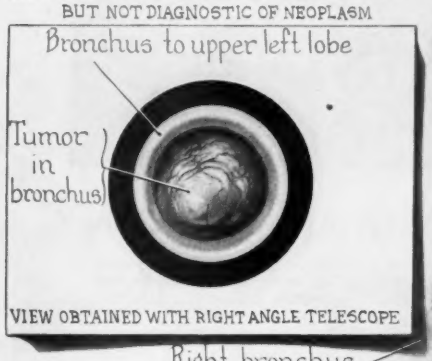

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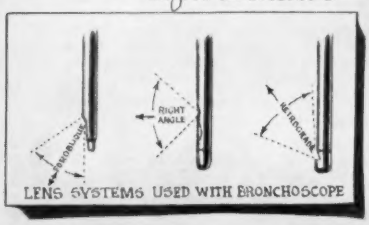

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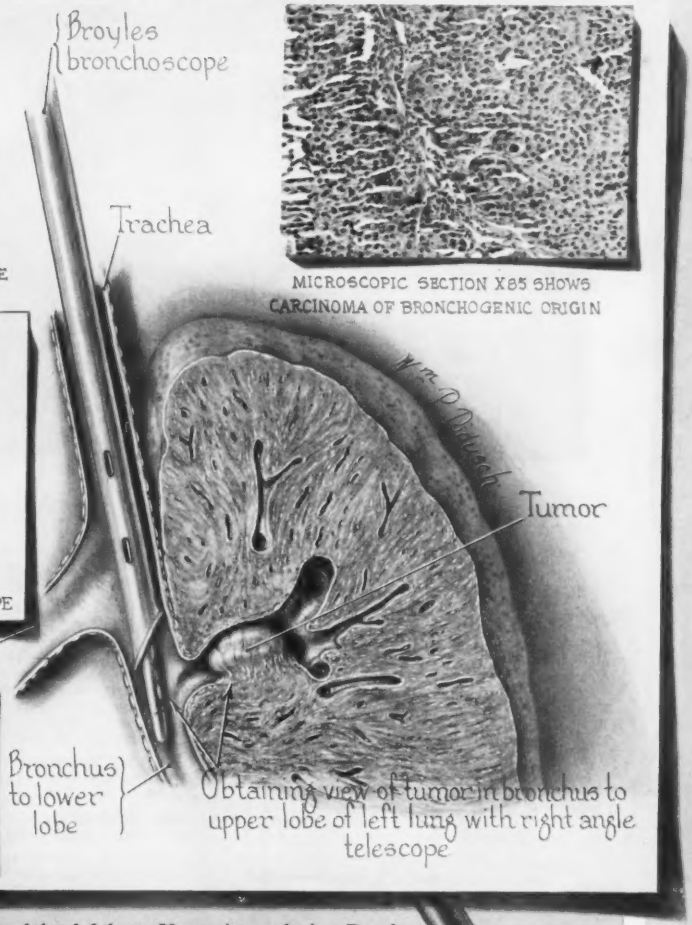
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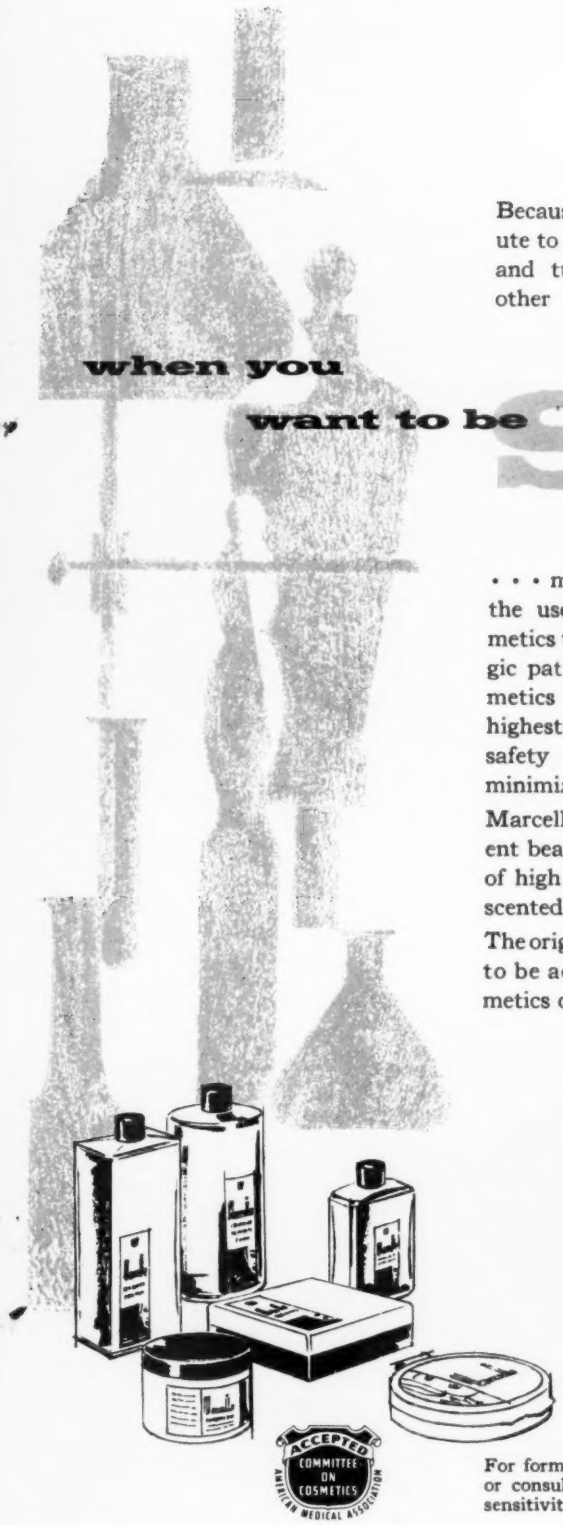

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